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TAKAHASHI (R.). **Insect Pests of Pineapple, especially** *Pseudococcus brevipes* **Ckll. 1.** [*In Japanese.*]—*Bull. agric. Res. Inst. Formosa* no. 161, 17 pp., 3 figs. Taihoku, 1939.

The insect pests of pineapple in Formosa comprise less than 20 species, this being due apparently to the absence of indigenous Bromeliaceae, the scarcity of insects on Monocotyledons, other than palms and grasses, and the hardness of the leaves of pineapple. Those recorded include *Pseudococcus brevipes*, Ckll., which is the most important, *Diaspis bromeliae*, Kern., Lamellicorn larvae and *Prodenia litura*, F. *Thrips tabaci*, Lind., is confined to *Allium* in Formosa and does not transmit any disease of pineapple. *Pseudococcus brevipes* is widely distributed in the lowlands and occurs up to about 2,500 ft. above sea-level. It is usually found only on pineapple, but is sometimes observed also on banana and *Cyperus*, although breeding experiments on *Cyperus* gave negative results. The pink forms, which are much more common than the grey ones, cause green spots on the leaves [*cf. R.A.E.*, A **24** 629] and are one of the causes of pineapple wilt. Near Taihoku, this mealybug has 6 or 7 generations annually, and all stages are present throughout the year, though first-instar nymphs do not survive longer than a day or two in January and February. After emergence, the females do not reproduce for 10–15 days in summer, 20–36 in spring and 56 or more in winter. They survive for about 40–50 days in summer and produce an average of 79 nymphs at the rate of 1–12 per day. They are usually viviparous, but commonly produce eggs in winter, most of which do not hatch. The nymphs pass through 3 instars and reach the adult stage in 28–40 days in summer and in 53–64 days in spring. Males are seldom produced, but appear in very small numbers in some strains. The adult females and nymphs become motionless when submerged for several hours in water, but many of them do not die even when submerged for 3 days. They are almost always visited by ants, and in their absence fungi growing on honey-dew sometimes cover the mealybugs and kill them. Natural enemies include the Cecidomyiid, *Schizobremia formosana*, Felt, and Coccinellids, which are less effective. The usual method of control is to fumigate the dried planting material with hydrocyanic acid gas. Fumigation with about 4 oz. sodium cyanide per 1,000 cu. ft. for 20 minutes at a minimum temperature of 27°C. [80·6°F.] gave complete mortality under experimental conditions, but a higher dosage is necessary in practice. New fields should not be planted near old ones.

MATSUMOTO (F.). **On the Life-history of** *Ischnodemus saccharivorus* **Okaj. injurious to Sugar-cane in Formosa (Lygaeidae, Heteroptera). 3.** [*In Japanese.*]—*Trans. nat. Hist. Soc. Formosa* **29** no. 195 pp. 303–313, 3 figs. Taihoku, 1939.

Further observations on the Lygaeid, *Ischnodemus saccharivorus*, Okaj., on sugar-cane in Formosa [*cf. R.A.E.*, A **24** 629] showed that the duration of the egg stage varies even in a single batch; it lasted 11–16 days in mid-summer, over 40–60 in early spring and 151–153 in winter. The nymphs, which pass through 5 instars, are present from late March to the end of June and from mid-July to early February, under the leaf sheaths and in the heart leaves. The average and maximum numbers of individuals observed on a single heart leaf were 13–14 and 50. The nymphal stage lasted 30–85 days, its duration varying with temperature.

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TAKAHASHI (R.). **Habits of** *Cappaea taprobanensis* **Dallas (Pentatomidae, Hemiptera).** [*In Japanese.*]—*Trans. nat. Hist. Soc. Formosa* **30** no. 196 pp. 22–25. Taihoku, 1940.

In Formosa, *Cappaea taprobanensis*, Dallas, is restricted to *Citrus*, to which it causes injury. Near Taihoku, overwintered adults of this Pentatomid begin to lay their eggs in masses of about 16 on the lower surfaces of the leaves in May, and nymphs are present until the end of September. There are 2 or 3 generations a year. The adults and older nymphs feed on the stems and branches, but the first-instar nymphs, which moult in about 3 days in summer, do not feed. The nymphs are gregarious in the first four instars and move about together in the second, third and fourth. In summer, the adults pair about 20 days after emergence.

TAKAHASHI (R.). **Observations on** *Rhynchocoris humeralis* **Thunb. (Pentatomidae), a** *Citrus* **Pest.** [*In Japanese.*]—*Formosan agric. Rev.* **37** no. 1 pp. 14–41, 1 pl., 5 figs. Taihoku, 1940.

Rhynchocoris humeralis, Thnb., which feeds only on *Citrus* and *Fortunella*, is common in the lowlands of Formosa and occurs up to about 4,300 ft. above sea-level. It sucks the juices from the fruits, leaves and branches; first-instar nymphs generally feed on the leaves, but nymphs in later instars do not develop, and adults do not reproduce, unless they feed on the fruits. The rostrum is very long after the second moult and is inserted deep into the fruits. The young fruits drop to the ground, and brown spots are caused through the skins of fruits of lemon and grapefruit. All species of *Citrus* are injured, lemon being seriously attacked in May and June. Descriptions are given of all stages of this Pentatomid and of the processes of feeding and metamorphosis. It usually has 2 or 3 generations a year. The adults overwinter on the food-plants; near Taihoku, they resumed activity in late April. They were very active at high temperatures, but flew little below 80°F. The females, which paired several times, lived for 87–92 days in summer, and the males for 33–73, but overwintering adults survive for 8 or 9 months. Oviposition occurred from late April to October. In experiments, one female deposited 18 and none less than 6 batches of about 14 eggs. The eggs hatched in 5 or 6 days in summer, and the nymphal stage lasted 36–40 days in hot weather.

The eggs are parasitised by the Eupelmid, *Anastatus colemani*, Crwf., which attacked up to 71 per cent. of the batches, and are destroyed by the predacious ant, *Tetramorium guineense*, F. The fruits can be protected by covering them with paper bags. Lemons should not be planted close to other *Citrus* trees. Control measures comprise hand collection of all stages, and spraying with derris against the nymphs.

KAYASHIMA (I.). **On the Injury of** *Oligotoma saundersi* **Westw. on** *Citrus* **Fruits, which may be a Cause of the Disease by** *Diplodia natalensis* **Evan. (Prelim. Rep.).** [*In Japanese.*]—*Shokubutsu-kensa Shiryo* **8** no. 4–6 pp. 17–19. Taihoku, 1939.

Observations in Formosa showed that a large percentage of *Citrus* fruits were infected by the fungus *Diplodia natalensis*, and that the Embiid, *Oligotoma saundersi*, Westw., was increasing on them;

4·3–14·2 per cent. of the fruits were infested by the insect, and of these 60–80 per cent. were infected by the fungus. In an experiment, 1·8 per cent. of uninfested fruits became infected by the fungus, but 36·4 per cent. of those artificially infested by the Embiid became infected in 10 days.

ESAKI (T.). **Insects injurious to Coconut Palm in the Mandated South Sea Islands of Japan. 1.** *Furcaspis oceanica* **Lindinger.** [*In Japanese.*]—*Oyo Kontyû* **2** no. 1 pp. 1–13, 2 pls., 5 figs. Tokyo, 1939.

Furcaspis oceanica, Ldgr., is widely distributed in the Japanese Mandated Islands and sometimes occurs in large numbers. The primary food-plant of this Coccid is the palm, *Bentinckiopsis ponapensis*, but it also attacks coconut and *Nipa fruticans*, which are imported.

YASHIRO (N.). **The Windbreakage in Sugar-cane and its Relation to the Damage by Moth Borers.** [*In Japanese.*]—*Oyo Kontyû* **2** no. 1 pp. 14–19, 2 figs. Tokyo, 1939.

Observations in the Loochoo Islands in 1937 showed that 37–54 per cent. of the sugar-cane stalks broken by typhoons, which commonly occur every year, were infested by the larvae of *Eucosma schistaceana*, Sn., or *Sesamia inferens*, Wlk.

YUASA (H.). **Immigration of** *Rhabdocnemis obscura* **Boisd. into Tokyo.** [*In Japanese.*]—*Oyo Kontyû* **2** no. 1 pp. 31–34, 1 fig. Tokyo, 1939.

The author states that *Rhabdocnemis* (*Sphenophorus*) *maculata*, Mats. (*nec* Gylh.) [*cf. R.A.E.*, A **25** 304] is a synonym of *R. obscura*, Boisd. This weevil was found in glass-houses at Tokyo and may possibly develop outdoors in warm seasons there.

NAKAYAMA (S.). **Multiplication of** *Calandra oryzae* **L. and Results of Control Experiments with two Insecticides.** [*In Japanese.*]—*J. Plant Prot.* **26** no. 11 pp. 785–788. Tokyo, 1939.

In investigations in 1938 on the rate of multiplication of *Calandra oryzae*, L., in Japan, the adult progeny of pairs of adults placed on 10th April in glass dishes about 3½ ins. in diameter and 2 ins. high containing rice, and kept in a dark box, was found on 1st September to number 252–614, with an average of 369. The numbers of adults obtained in a similar experiment that lasted from 1st July to 1st September varied from 112 to 397 and averaged 178. In investigations on the control of the weevil, a new proprietary fumigant gave complete mortality of adults, but not of larvae and pupae, and was slightly superior to chloropicrin.

NAKAYAMA (S.). **Observations on the Injury of** *Grapholitha glycinivorella*, **Mats., and Varieties of Soy Beans.** [*In Japanese.*]—*J. Plant Prot.* **26** no. 12 pp. 868–875. Tokyo, 1939.

In Korea, *Cydia* (*Grapholitha*) *glycinivorella*, Mats., injures an average of 4·17 per cent. of the seeds of soy beans in pods in the field. Near Suigen, late varieties are the most damaged [*cf. R.A.E.*, A **27** 19].

KUWAYAMA (S.). **Rice Leaf-hoppers in Hokkaido.** [*In Japanese.*]—*J. Plant Prot.* **27** no. 1 pp. 18–21. Tokyo, 1940.

Several species of leafhoppers (Fulgoroids and Jassids) occur on rice in Hokkaido, and they caused very serious damage in 1924. Only one of them, however, *Sogata furcifera*, Horv., which is by far the most abundant, is known to be responsible for severe injury. If temperatures are above the average and rainfall less than usual in July and early August, outbreaks of this Delphacid occur in late August and September. It is parasitised by two Dryinids.

YAGO (M.) & FURUGORI (N.). **Aphids infesting Pear, especially on *Toxoptera piricola* Mats. 1.** [*In Japanese.*]—*J. Plant Prot.* **27** no. 1 pp. 29–33. Tokyo, 1940.

The author gives a list of the 23 Aphids that are known to occur on pear trees in Japan, 13 of which have been observed in Shizuoka Prefecture, and describes all stages of *Toxoptera piricola*, Mats.

ODA (F.). **Dose and Effective Spraying Periods of Resin Wash against *Ceroplastes rubens* Mask.** [*In Japanese.*]—*J. Plant Prot.* **27** no. 2 pp. 42–52. Tokyo, 1940.

Investigations in Fukuoka Prefecture, Kyushu, showed that the best control of *Ceroplastes rubens*, Mask., which is a serious pest of *Citrus* and other trees in Japan, is given by a single application of a resin wash in early August, when all the larvae have appeared. The formula recommended is 1 part of a mixture of 25 oz. resin, 1 lb. caustic soda and 6 pints water diluted with 25 parts water.

MIZUIDE (Z.). **On the Effectiveness of Stomach Poisons against the Larvae of *Vanessa io* L.** [*In Japanese.*]—*J. Manchuria agric. Soc.* **1** no. 1 pp. 141–143. Koshurei, Manchoukuo, 1939.

The larvae of *Vanessa io*, L., are very injurious to hops in Manchuria. They can be effectively controlled by a spray of 1 lb. lead arsenate and 1 lb. calcium caseinate in 100 gals. water, which gives better results than one of calcium arsenate.

KUROSAWA (M.). **Note on the Pear Thrips unknown to Japan.** [*In Japanese.*]—*Kontyû* **13** no. 4 pp. 139–143, 2 figs. Tokyo, 1939.

A description is given of *Taeniothrips inconsequens*, Uzel, which was taken on an unidentified plant in Japan.

HARUKAWA (C.) & KUMASHIRO (S.). **Studies on *Hylemyia cilicrura* Rond. 5. On *Eucoela tanebae* Ishii.** [*In Japanese.*]—*Nogaku Kenkyu* **31** pp. 290–306. Kurashiki, 1939.

Near Kurashiki, Okayama Prefecture, *Hylemyia cilicrura*, Rond., is parasitised by *Eucoila tanebae*, Ishii. Females of this Cynipid oviposit in young larvae of the host, and the adults emerge from the puparia. It apparently has two generations a year and overwinters in the larval stage. The adults are present from early April until about the end of May and again in October and November. When fed on diluted honey, they survive for about 23 days in May and 28 days in autumn. The females slightly outnumber the males. Pairing and

oviposition occur soon after emergence. The larvae resume development in spring when the temperature reaches 11–12°C. [51·8–53·6°F.] and pupate in April. In summer, they aestivate at temperatures above 20°C. [68°F.] and pupate in late September. The percentage parasitism averaged about 10 in late April, reached a maximum of 40–60 in May, and averaged 15–16 with a maximum of 24 in autumn. The puparia of parasitised hosts are somewhat shorter than those of healthy ones.

SIRAIWA (H.). **Two new Scale Insects from Japan.**—*Trans. Kansai ent. Soc.* **9** pp. 16–18, 2 pls. Osaka, 1939.

Phenacoccus ardisiae, sp. n., on *Ardisia*, and *Phenacaspis susukicola*, sp. n., on *Miscanthus*, are described from Japan.

ISHIKURA (H.). **Effect of Fumigation with Chloropicrin upon the Respiration of Rice Borers at low Temperatures.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **11** no. 5 pp. 189–195, 1 fig. Tokyo, 1939.

Fumigation with chloropicrin for 5–20 minutes causes a decrease in oxygen consumption by hibernating larvae of *Chilo simplex*, Btlr. [*cf. R.A.E.*, A **27** 338]. When the amount of oxygen consumed was decreased by more than 40–50 per cent. at 15°C. [59°F.], death ensued.

NOGUCHI (T.) & HIRAIWA (Y.). **Studies on Measures for the Control of *Prontaspis yanonensis* Kuwana.** [*In Japanese.*]—*Extra Rep. Shizuoka agric. Exp. Sta.* no. 47, 19 pp. Shizuoka, 1939.

Fumigation with hydrocyanic acid gas is the best method of controlling *Prontaspis yanonensis*, Kuw., on *Citrus* in Japan [*cf. R.A.E.*, A **25** 676], and it is more effective in autumn than in winter. Spraying with oil emulsions, which is next in effectiveness, gives better control in summer than in winter. It is not possible by either of these methods to reduce the infestation of fruits to any considerable extent in a single season, and they should be repeated for 4 or 5 successive years. Fumigation shows a greater tendency to increase the numbers of flowers and to encourage the growth of the fruits than summer spraying, which seems slightly to retard budding.

NAGAOKA (N.). **On the Larva and Pupa of *Tenebrio obscurus* F.** [*In Japanese.*]—*Insect World* **44** no. 1 pp. 4–7, 1 pl. Gifu, 1940.

Brief descriptions are given of the larva and pupa of *Tenebrio obscurus*, F., which feeds on various stored products, including dried sweet potato, at Tokyo. The larvae pass through at least 7 or 8 instars, each lasting about a month, and the winter is generally passed in the larval stage.

YAMADA (Y.). **On *Attagenus piceus* Oliv., a Pest of Woollen Cloth.** [*In Japanese.*]—*Bochu Kagaku* no. 3 pp. 1–10, 1 pl. Kyoto, 1939.

Near Kyoto, the adults of *Attagenus piceus*, Ol., are most common outdoors in June, many being found in the flowers of carrot. In breeding experiments, they emerged mostly at night in the second half

of May. The average longevity of either sex was just over 24 days; pairing occurred 5 or 6 days after emergence, and the average number of eggs per female was 72·85. The durations of the egg and pupal stages averaged 16·06 and 13·09 days.

YAMADA (Y.). **The Relation of Injury of Insect Pests of Woollen Cloth to Temperature.** [*In Japanese.*]—*Bochu Kagaku* no. 3 pp. 19–26. Kyoto, 1939.

It has been observed in Japan that the larvae of *Attagenus piceus*, Ol., and *Anthrenus verbasci*, L., feed only at the edges of woollen cloth at low temperatures, but attack any part at high ones. The larvae of these two Dermestids become dormant at 10 and 4°C. [50 and 39·2°F.], respectively.

YAMADA (Y.). **On the Flowers visited by Adults of *Anthrenus verbasci* L.** [*In Japanese.*]—*Bochu Kagaku* no. 3 pp. 27–31, 1 fig. Kyoto, 1939.

The adults of *Anthrenus verbasci*, L., have been observed visiting the flowers of plants belonging to 46 species in 9 families. Those most favoured are chestnut, *Brassica*, *Photinia*, carrot, onion and *Chrysanthemum*, all of which have flowers that are white or nearly so.

ISHII (T.). **New Chalcidoid and Proctotrypoid Wasps reared from Forest Insects by Dr. H. Kôno.**—*Kontyû* **13** no. 5–6 pp. 187–191. Tokyo, 1939.

The new species are: the Eulophid, *Euderus jezoensis*, from *Scolytus* (*Eccoptogaster*) sp. on *Picea jezoensis* in Hokkaido; and the Pteromalids, *Uriella pityogenis* and *Roptoceroidea karafutoensis*, gen. et sp. n., from *Ips* (*Pityogenes*) *aizawai*, Kôno, *R. ips* from another species of *Ips*, and the Scelionid, *Telenomus konoi*, from eggs, probably of Rhynchota, all on *P. jezoensis* in Sakhalin.

HARUKAWA (C.) & TOKUNAGA (M.). **Studies on the Life History and Bionomics of *Phyllotreta vittata* Fabricius II. On the Hibernation of the Flea-beetle.** [*In Japanese.*]—*Kontyû* **13** no. 5–6 pp. 208–221, 1 fig., 4 refs. Tokyo, 1939. (With a Summary in English.)

The following is based on the authors' summary of this report on the continuation of studies on the bionomics of *Phyllotreta vittata*, F., in Japan, where it is a serious pest of cruciferous vegetables [*cf. R.A.E.*, A **26** 769]: From studies of hibernation carried out under field conditions at Kyoto, it was found that only the adults can survive the winter, mortality in this stage being very low. There is only a temporary suspension of activity due to low temperature and no true diapause. The winter is passed among weeds on the margin of the field or under shelter on the surface of the ground in the field itself. The adults enter hibernation almost uniformly in the late autumn when the temperature falls to about 11°C. [51·8°F.] and emerge in spring over a considerable period when the temperature is about 13°C. [55·4°F.]. There are no differences between the sexes in winter mortality or behaviour in relation to hibernation. The effect on the beetles of exposure to cold is studied statistically by the method of calculation used by Bliss for the dosage-mortality curve [**23** 493, 497].

Kôno (H.) & Sawamoto (T.). **Ueber den Artnamen der an Sachalintannen und Yezofichten schädlichen** *Dendrolimus*-**Art.** [On the specific Name of the Species of *Dendrolimus* that infests *Abies sachalinensis* and *Picea jezoensis*.] [*In Japanese.*]—*Kontyû* **13** no. 5–6 pp. 229–230. Tokyo, 1939.

Dendrolimus sibiricus, Tshtv., *D. jezoensis*, Mats., and *D. albolineatus*, Mats., are stated to be synonyms of *D. superans*, Btlr., which is widespread in Sakhalin, the southern Kurile Islands, Japan, Siberia and Manchuria. The larvae feed on hemlock (*Tsuga*), silver-fir (*Abies*), spruce and larch, but only rarely attack the long needles of pine.

Watanabe (C.). **Preliminary Notes on the Hymenopterous Parasites of the Mulberry Pyralid Moth,** *Margaronia pyloalis* **Walker.** [*In Japanese.*]—*Kontyû* **13** no. 5–6 pp. 231–236, 12 refs. Tokyo, 1939.

A list is given of 16 Hymenopterous parasites that have been recorded from the mulberry moth, *Margaronia pyloalis*, Wlk. Those that occur in Japan are the Braconids, *Phanerotoma planifrons*, Nees, and *Macrocentrus philippinensis*, Ashm., of which *P. formosana*, Rohw. [*R.A.E.*, A **22** 324] and *M. japonicus*, Watan. [**22** 240; **26** 296], respectively, are synonyms, the Ichneumonid, *Pimpla* (*Epiurus*) *persimilis*, Ashm., and the Bethylid, *Goniozus japonicus*, Ashm.

Seok (D. M.). **On the three Pentatomid Bugs affecting** *Zelkowa serrata* **Makino and their Control.** [*In Japanese.*]—*Kontyû* **13** no. 5–6 pp. 246–248. Tokyo, 1939.

The Pentatomids found on *Zelkova serrata* in Korea are *Pentatoma japonica*, Dist., which is the most abundant, *Okeanos quelpartensis*, Dist., and *Dinorhynchus dybowskyi*, Jakovlev. *D. dybowskyi* and the full-grown nymphs of *P. japonica* are predacious on other insects. The adults of *P. japonica* appear in July and oviposit in September. The eggs are laid in masses of over 60 and hatch in about 15 days. The nymphs hibernate in the second instar in crevices at the base of the stems of the trees.

Monzen (K.). **Effects of the Agromyzid Leaf-miner on the Growth of the Rice Plant.** [*In Japanese.*]—*Kontyû* **13** no. 5–6 pp. 251–253. Tokyo, 1939.

Oscinis oryzella, Mats., has caused serious damage to rice in northern Japan in recent years [*cf. R.A.E.*, A **27** 225, etc.]. The larvae mine the leaves from the apex and cause them to wither. Infested plants attain the normal height, but the numbers of side shoots are reduced.

Sakai (K.). **Comparison of the Red Scale** (*Aonidiella aurantii* (**Maskell**)) **and its allied Species in Japan.** [*In Japanese.*]—*Ōyō-Kontyū* **2** no. 2 pp. 45–62, 14 figs., 36 refs. Tokyo, 1939. (With a Summary in English.)

An account based on the literature and personal observations is given of the morphology, bionomics and distribution of the species of *Aonidiella* that occur in Japan. The author agrees that *A. aurantii*, Mask. (red scale) and *A. citrina*, Coq. (yellow scale), which are the only

species found on *Citrus*, are distinct [*cf. R.A.E.*, A **22** 134] and quotes from a paper by McKenzie [**26** 469] characters distinguishing these two species. *A. taxus*, Leon., and *A. inornata*, McKenzie, have both been misidentified in Japan as *A. aurantii* [*cf.* **28** 255], and records of *A. aurantii* on *Podocarpus* refer to *A. taxus*. The Japanese host of the Encyrtid, *Comperiella bifasciata*, How., is not *A. aurantii* [*cf.* **25** 77] but *A. taxus*, and it is therefore unnecessary to explain its failure to parasitise *A. aurantii* in California [**15** 249; **25** 77] by a theory of biological races of the latter [**18** 692]. *A. aurantii* is parasitised in Japan by *Aspidiotiphagus citrinus*, Craw, and *Aphytis* (*Aphelinus*) *chrysomphali*, Merc.

Tateisi (I.). **Notes on *Leptocorisa varicornis* Fabricius, a Pest of the Rice-plant in Hukuoka Prefecture.** [*In Japanese.*]—*Ōyō-Kontyū* **2** no. 2 pp. 63–71, 3 figs., 20 refs. Tokyo, 1939.

Leptocorisa varicornis, F., all stages of which are described, occurred in large numbers in some districts of Hukuoka Prefecture, Kyushu, in 1935 and 1937, and caused serious damage to upland rice. This Coreid sucks the juice from the ears, and in cases of severe infestation the crop is reduced by 50 per cent. The earliest varieties are the most damaged. The adults, which have been found overwintering on a coniferous tree (*Cryptomeria*), migrate to grasses in April and May, and attack rice from mid-July to late October. Nymphs of all instars occur from late August to November. Control measures, which should be carried out in the early morning when the bugs are inactive, comprise hand collection and dusting with pyrethrum.

Okamoto (D.). **Notes on the Life-history and Control of *Odites ricinella* Stainton (Lep.), an Apple-tree Pest.** [*In Japanese.*]—*Ōyō-Kontyū* **2** no. 3 pp. 93–106, 2 figs. Tokyo, 1939.

Descriptions are given of all stages of *Odites ricinella*, Stn., which causes considerable damage to apple in Korea, especially in late July and early August, and also attacks pear, peach, plum, cherry and grape-vine. The larvae mine the leaves for 4–14 days and then roll the edges of the leaves. Immature larvae enter hibernation in cocoons in crevices on the stems in September or October, resume activity in late April, and pupate in June. There are two or three generations a year, the adults emerging from June to September. The egg, larval and pupal stages last 6–16, 18–39 and 6–11 days, respectively, and males and females survive for about 5–11 and 5–8 days. Apple was preferred for oviposition, even by females from larvae bred on vine or pear. Females deposited about 500 eggs, mostly on the lower surfaces of the leaves along the ribs. This Tineid was attacked by a number of undetermined Hymenopterous and Tachinid parasites; the control measures recommended include cleaning the trees in winter, and spraying with oil emulsion against the hibernating larvae or with lead or calcium arsenate before the eggs hatch.

Kuwayama (S.), Yamada (S.) & Mori (Y.). **On *Prosena siberita* Fab.** [*In Japanese.*]—*Ōyō-Kontyū* **2** no. 3 pp. 107–110. Tokyo, 1939.

The Tachinid, *Prosena siberita*, F., which parasitises the larvae of the Rutelid, *Anomala geniculata*, Motsch., in Hokkaido, has one

generation a year and overwinters in the larval stage in the host. The larvae leave their hosts from late June onwards to pupate in the soil, and the adults occur from late July until early September. The larvae are deposited while the adults are in flight and enter the soil in search of a suitable host. Larvae dissected from gravid females attacked hosts normally. The percentage parasitism averaged 13·4 in one locality in June and 5·2 in another in October.

Sawa (R.) & Tamura (I.). **On the Outbreaks of a *Serica* in a newly cultivated Area.** [*In Japanese.*]—*Ōyō-Kontyū* **2** no. 3 pp. 110–113, 4 figs. Tokyo, 1939.

Serious injury has been caused in April and May to rye, maize, mulberry, potato, radish, cucumber and beans in a newly cultivated area in Ibaragi Prefecture, Japan, by the adults of a Melolonthid of the genus *Serica*. Good control was given by a spray of lead arsenate in Bordeaux mixture.

Saito (K.). **Biology of *Asiates sanguinipennis* Blessig.** [*In Japanese.*] —*Ōyō-Kontyū* **2** no. 3 pp. 114–116, 2 figs. Tokyo, 1939.

In Korea, *Asiates sanguinipennis*, Blessig, has one generation a year and overwinters in the larval stage. The adults emerge in May. The food-plants of this Cerambycid include *Benzoin obtusilobum* and *Acer saccharum*; the injury caused is briefly described.

Yashiro (H.). **Relation of the Outbreaks of Leafhoppers to Typhoons.** [*In Japanese.*]—*Ōyō-Kontyū* **2** no. 3 pp. 119–120. Tokyo, 1939.

In 1938, the Delphacids, *Nilaparvata oryzae*, Mats., and *Sogata furcifera*, Horv., occurred in unusually large numbers from August to October in the Loochoo Islands and caused serious damage to rice. The outbreak seems to have been favoured by the absence of typhoons during the summer.

Sonan (J.). **Observations on *Cifuna locuples* Walk.** [*In Japanese.*]—*Bull. agric. Res. Inst. Formosa* no. 167, 33 pp., 1 pl., 1 fig. Taihoku, 1940.

The larvae of the Lymantriid, *Cifuna locuples*, Wlk., all stages of which are described, feed on a great variety of plants in Formosa, including beans, peas, derris, maize, wheat and rice, but do not cause serious injury. This Lymantriid has five generations a year. The larvae overwinter and resume feeding in March, the first adults emerging in late April. The life-cycle is completed in 50–63 days between April and October, the egg and larval stages lasting 5–11 and 35–40 days. The larvae are gregarious in the earlier instars. The adults are attracted to light, and females deposit an average of 280 eggs in batches of 50–200.

Compendium for the Control of Fungous and Insect Pests of Manchuria. [*In Japanese.*]—440 pp., 24 pls. Koshurei, Govt. agric. Exp. Sta., Manchuria, 1939.

This book on the control of insect and fungous pests of economic plants in Manchuria includes a general section in which accounts are

given of control methods, insecticides and spraying apparatus. The more important insect pests and the appropriate measures for their control are then briefly dealt with under their food-plants.

KUWAYAMA (S.] **Insect Pests of north-eastern Asia and their Control.** [*In Japanese.*).—*Bot. & Zool.* **8** no. 1 pp. 253–258. Tokyo, 1940.

Comparatively few species of insect pests occur in north-eastern Asia, but they are represented by large numbers of individuals. The vegetation period is short, and consequently infested plants do not have time to recover from injury. The development of some of the insects is considerably retarded by the low temperature. Thus, the life-cycle of *Anomala rufocuprea*, Motsch., requires three years in Hokkaido, as compared with one near Tokyo, and *Chilo simplex*, Btlr., which usually has two generations a year on the mainland of Japan, has only one in Hokkaido and northern Manchuria. Few species of Coccids occur in Sakhalin, Hokkaido and northern Manchuria. Some species of Trichoptera injure rice plants in this region.

ESAKI (T.). **Fauna of injurious Insects of the Japanese Mandated South Sea Islands and their Control.** [*In Japanese.*]—*Bot. & Zool.* **8** no. 1 pp. 274–280. Tokyo, 1940.

The insect fauna of the Japanese Mandated Islands is not large, and many of the insect pests of cultivated plants are imported species. Lists are given of those that attack the more important crops. Coconut is seriously damaged by *Aspidiotus destructor*, Sign., which was imported into Yap about 1892, but outbreaks are now controlled by the introduced Coccinellid, *Cryptogonus orbiculus nigripennis*, Weise. *Planispa castaneipennis*, Chûjô [*cf. R.A.E.*, A **26** 336] was imported into Saipan from Yap about 1928 and also causes serious damage to coconut. *Rhabdocnemis obscura*, Boisd., is more injurious to sugar-cane than to palms. Other pests include: *Trionymus sacchari*, Ckll., *Neomaskellia bergi*, Sign., *Anomala sulcatula*, Burm., and *Dasus* (*Gonocephalum*) sp. on sugar-cane; *Pyrausta nubilalis*, Hb., which is very injurious, and *Peregrinus maidis*, Ashm., on maize; *Cnaphalocrocis medinalis*, Gn., *Sogata furcifera*, Horv., and *Nephotettix bipunctatus*, F., on rice; *Cylas formicarius*, F., and *Halticus tibialis*, Reut., on sweet potato; *Platyedra* (*Gelechia*) *gossypiella*, Saund., *Earias fabia*, Stoll, *Margaronia indica*, Saund., and *Dysdercus cingulatus*, F. (*megalopygus*, Breddin) on cotton; *Ferrisiana virgata*, Ckll., and *Coccus viridis*, Green, on coffee; the Lamiid, *Nanyohammus luteosparsus*, Matsushita, on cacao; *Aphis laburni*, Kalt., on beans; and *Leptoglossus membranaceus*, F., on beans and cucurbits. *Citrus* is attacked by various Coccids, but *Icerya purchasi*, Mask., is absent, and infestation by *I. aegyptiaca*, Dgl., is reduced by *Rodolia koebelei*, Oliff, except in Yaluit. *Prays citri*, Mill., causes galls on *Citrus* fruits. There are no important pests of banana, although *Cosmopolites sordidus*, Germ., has been recorded from Guam.

KAWADA (T.). **Present Features of the Studies of *Schoenobius incertellus*, Walk.** [*In Japanese.*]—*Bot. & Zool.* **8** no. 1 pp. 281–285. Tokyo, 1940.

Schoenobius bipunctifer, Wlk. (*incertellus*, Wlk.), which is a serious pest of rice, is spreading eastwards on the southern coast of western

Honshu, and has recently been observed in Mie Prefecture. In Kagoshima Prefecture, Kyushu, it has caused considerable injury, but protection has been afforded by postponing the planting of rice until after 5th June, as the adults of the overwintered generation emerge from early May to early June, the species is monophagous, and the larvae do not develop in seedling rice. Light-traps are extensively used against the adults in some Prefectures.

KUSUNOME (M.) & UMETSU (R.). **A new Control Method of Fig Borers.** [*In Japanese.*]—*Agric. & Hort.* **15** no. 1 pp. 168–170, 3 figs. Tokyo, 1940.

Longicorns are important pests of fig trees in Japan. In experiments in which suspensions or solutions of lime, lead arsenate, pyrethrum, nicotine sulphate and derris were injected into the mines in the stems and branches by means of a pump, the best results were given by lead arsenate and pyrethrum, which killed 96 and 83·1 per cent. of the larvae, respectively.

TAKAHASHI (R.). **Descriptions of three Malayan Coccidae (Hemiptera).** —*Trans. nat. Hist. Soc. Formosa* **29** no. 188 pp. 111–118, 3 figs. Taihoku, 1939.

Descriptions are given of the adult females of *Formicococcus corbetti*, sp. n., on *Mangifera indica*, *Paralecanium milleri*, sp. n., on *Anona muricata*, and *P. vacuum*, Morr., on *Durio zibethinus*, all in Malaya.

TJOA TJIEN MO. **Aanteekeningen over de parasieten van *Hidari irava* in verband met de oecologie dezer plaag.** [Notes on the Parasites of *H. irava* in Relation to the Ecology of this Pest.]—*Landbouw* **15** pp. 493–509, 13 figs., 16 refs. Buitenzorg, 1939. (With a Summary in English.)

Hidari irava, Moore, is one of the most harmful pests of coconut in the Netherlands Indies. Details are given of serious outbreaks that have occurred in Java, Sumatra and Borneo, with notes on the parasites recorded from this Hesperiid by various workers in these islands and on one species found in Bali. All the identified species found in Sumatra and Borneo also occur in Java, where those of most importance are the Scelionid, *Telenomus* (*Neotelenomus*) *javae*, Gir., which parasitised 34 per cent. of the eggs in 1931, the Braconid, *Apanteles agilis*, Ashm., and the Tachinid, *Sturmia inconspicuoides*, Baranov, which parasitised 18 and 20 per cent. of the larvae, respectively, in 1927, and the Chalcid, *Brachymeria euploeae*, Westw., and the Ichneumonid, *Xanthopimpla gampsura*, Krieger, which parasitised 15 and 17 per cent. of the pupae, respectively. The two pupal parasites are also of importance in Borneo, but egg parasites have not been recorded there. If they are really absent, *T. javae* should be introduced. A high percentage of the eggs are parasitised in Sumatra, but it is not known whether *Xanthopimpla* is present there. *A. agilis* is itself attacked by two Chalcidoid parasites, but they are of no practical importance.

CHERIAN (M. C.) & PILLAI (B. Rangiah). *Semiothisa* (*Macaria*) *pervolgata* **Wlk. a Geometrid Pest of Daincha** (*Sesbania aculeata*).—*Madras agric. J.* **26** no. 5 pp. 166–168. Madras, 1938. [Recd. 1939].

Semiothisa (*Macaria*) *pervolgata*, Wlk., which had not previously been recorded as a pest, caused severe damage to *Sesbania aculeata*,

an important green manure plant, in Coimbatore in 1936. The crop was sown in mid-February, and almost the whole of the two-acre plot was defoliated by mid-May, when the Geometrid had become very numerous and was beginning to invade adjoining areas. In June, however, it was controlled by the Braconid, *Apanteles hypsipylae*, Wlksn.

The eggs of *S. pervolgata* are laid singly on the leaves and tender shoots of the food-plant, and the larvae pupate in or on the soil. The durations of the egg, larval and pupal stages were 3–4, 8–12 and 6–8 days, respectively. In captivity, adults lived up to 12 days when fed on honey solution, and females laid 156–283 eggs. Brief descriptions are given of all stages. The life-cycle of *A. hypsipylae* lasted 14 days, and adults lived up to 14 days when fed on sugar solution. They showed some preference for ovipositing in larvae of medium size, which remained active and continued to feed until the mature parasite larvae emerged. The cocoons were spun under the shrunken bodies of the hosts in clusters of 6–20, and one or two of these clusters were found on nearly half the plants in the infested plot in June. Two unidentified hyperparasites were observed.

Sprays or dusts of calcium arsenate and lime (1 : 6) did not give satisfactory control of *S. pervolgata*, as they did not adhere to the leaves. Baits of extract of the pods of *Sesbania aculeata* with molasses and the same scented with a few drops of citronella oil did not attract the moths. A light-trap having a 300 candle power Petromax light operated between 7 and 10 p.m. on 6th, 7th, 8th and 9th June caught a total of 161 gravid females, 84 spent females and 281 males ; catches were considerably reduced on the four following evenings, and no gravid females were taken on the last three of them. In a serious outbreak, the moths can be disturbed in large numbers and caught in nets.

Cherian (M. C.) & Kylasam (M. S.). **Tobacco Stems as a useful Source of Nicotine for insecticidal Purposes.**—*Madras agric. J.* **27** no. 2 pp. 55–58. Madras, 1939.

It is the usual practice in India to use tobacco waste for preparing nicotine sprays, but the stems are generally discarded. An account is given of investigations at Coimbatore in 1938 on the possibility of using them also. Three extracts were made, one by soaking 1 lb. chopped stems in 1 gal. rain water for 12 hours, and two others by boiling 1 lb. chopped stems for 15 and 60 minutes, respectively ; all amounts were made up to 1 gal., and these stock solutions were found to contain 0·086, 0·055 and 0·070 per cent. nicotine when prepared from stems containing 0·1433 per cent. There was little difference in nicotine contents when tap water was substituted for rain water, but they were somewhat less when the stems had been stored for 4 months. For use, the solution was diluted to various strengths, and $\frac{1}{4}$ oz. soap per gal. was added as a wetter.

In field tests against *Aphis gossypii*, Glov., carried out on 29th March and in which counts were made 6 hours after spraying, the three solutions gave percentage mortalities of 100, 98·1 and 100 when undiluted, 98·1, 97·2 and 100 at a dilution of 1 : 1, 100, 94·4 and 95·2 at 1 : 2, and 100, 42·1 and 99·8 at 1 : 3 ; the percentage mortality in controls sprayed with water only was 7. In similar tests made against *Scirtothrips dorsalis*, Hood, in December, a solution containing

0·051 per cent. nicotine gave percentage mortalities of 97·2 when undiluted and 90·2, 97·1 and 65·9 at dilutions of 1 : 1, 1 : 2 and 1 : 3. Analyses of samples of leaves of 17 varieties of tobacco grown in the Madras Presidency showed that the nicotine content varied from 1·851 to 6·080 per cent. ; the stems that contained 0·1433 per cent. were from the variety that had 6·080 per cent. in the leaves, and it is estimated that an acre of tobacco would yield 400 lb. stems, which would be sufficient to prepare 1,200 gals. spray.

CHERIAN (M. C.) & ISRAEL (P.). **Notes on *Perina nuda* Fabr. (Lymnt. Lepid.), and its natural Enemies.**—*Madras agric. J.* **27** no. 6 pp. 203–207, 9 refs. Madras, 1939.

Perina nuda, F., occasionally causes damage to fig trees in India when it becomes unusually abundant ; the larvae feed on the leaves, leaving only the mid-ribs and larger veins. The distribution and food-plants of this Lymantriid are summarised from the literature, and all stages are described. In investigations in 1935–36, the egg, larval and pupal stages of 15 individuals kept under observation lasted 5–6, 15–28 and 5–9 days. Pupation took place in leaves folded by the larvae. The adults, which lived for up to 11 days, usually became active at dusk ; females laid 57–409 eggs, usually in clusters on the lower surfaces of the leaves. The eggs were parasitised by an unidentified Chalcid, and the larvae by an undescribed Braconid of the genus *Megarhogas*, the Tachinid, *Tricholyga sorbillans*, Wied., the Chalcid, *Brachymeria euploeae*, Westw., and the Ichneumonid, *Goryphus nursei*, Cam. Effective control was given by sprays of lead or calcium arsenate (½ oz. per gal.), and by dusting with flowers of sulphur, which acted as a repellent.

Females of *T. sorbillans*, which deposited 40–85 eggs, preferred to oviposit on hosts that were ready to pupate. The larvae hatched in 1 day and entered the host, on which they fed for 4 days. They left it to pupate, 1–3 emerging from individual hosts. The life-cycle lasted 17–21 days, and females survived for 20–25 days. Very brief notes are given on the bionomics of the other parasites.

Citrus Pests and their Control.—*Palestine Gaz.* April 1939, *Agric. Suppl.* no. 40 pp. 73–76. [Jerusalem] 1939.

The most important pests of *Citrus* in Palestine are Coccids, many of which are favoured by the increased shade provided as the trees advance in age. *Chrysomphalus ficus*, Ashm., is particularly injurious in the Acre area and the upper Jordan valley, but has remained fairly localised during the last few years. Fumigation with liquid hydrocyanic acid between mid-December and mid-February in the Jordan valley and in early summer in the coastal areas is recommended. *Aonidiella aurantii*, Mask., which occurs in the coastal plain, the Emeq and the Jordan valley but does not develop on trees attacked by *C. ficus*, can be satisfactorily controlled by fumigation with hydrocyanic acid gas. There was a marked increase in 1938 in the area under *Citrus* infested by *Lepidosaphes beckii*, Newm., which prefers old trees. It has spread from Petah Tiqva to many places in the coastal plain, and is believed to occur as far north as Benyamina. *Icerya* [*purchasi*, Mask.] is found in many orange-growing districts, but is rarely of economic importance. The introduced Coccinellid,

Rodolia (*Novius*) *cardinalis*, Muls., continues to afford satisfactory control [*cf. R.A.E.*, A **21** 176]. *Pseudococcus comstocki*, Kuw., and other mealybugs are considered to be dangerous pests of *Citrus* in Palestine.

Damage due to infestation by the Mediterranean fruit fly [*Ceratitis capitata*, Wied.] has not been great since 1935–36 [*cf.* **26** 406]; infested fruits should be destroyed, and bait-sprays [*cf.* next abstract] should be used. Red spiders [*cf.* **25** 749–752] cause defoliation of *Citrus* trees and discoloration of fruit. These mites can be controlled by dusting with sulphur in June and again in October in the Jordan valley, with an intermediate application if they are very numerous. In the coastal plain, where infestation is greatest during August, September and October, one application should be made in July and another in September. A single application of a 1·5–2·0 per cent. white-oil emulsion sometimes controls red spiders and Coccids.

Biology of and Control Experiments on the Mediterranean Fruit Fly (*Ceratitis capitata* Wied. Dipt. Tryp.) in the Emeq (Valley of Esdraelon).—*Palestine Gaz.* September 1939, *Agric. Suppl.* no. 45, pp. 188–192. [Jerusalem] 1939.

Ceratitis capitata, Wied., is one of the major insect pests of fruit in Palestine. Much of the information here given on its bionomics and the damage it causes has already been noticed [*R.A.E.*, A **26** 406]. There are 7–8 generations in the year in the Valley of Esdraelon, 9 in the Jordan valley and 4–5 in the coastal plain. The oviposition period lasts 2–4 weeks, but some females do not oviposit until 2–3 months after emergence. The egg and larval stages last 3–7 and 15–21 days, respectively, and the pupal period varies from 7–10 days in summer to nearly 3 months in winter. The summer generations breed in deciduous fruits, and infestation of *Citrus* begins in late October. In October and November, 98–99 per cent. of the eggs and young larvae in fruits of orange and lemon are destroyed by secretions from the wounded skin. In November and December, 12–25 per cent. of the grapefruits attacked become infested, and this percentage rises to 25 or 50 in January and February. Mandarin oranges are the only *Citrus* fruits in which oviposition practically always results in the larvae becoming established. Only about 1 per cent. of the *Citrus* fruit picked by mid-April is damaged, but all late grapefruits and Valencia oranges become infested in late April and May. Almost all apricots and peaches are infested, as they usually ripen in May–June, July and September–October, at the peaks of abundance of the flies. Between 20 and 25 per cent. of plums ripening at the end of July and in August, and up to 40 per cent. of those ripening in June and the beginning of July are infested. Apples ripening in July are more severely damaged than those ripening in August, and 60–70 per cent. of two varieties of pears ripening in June and July are destroyed. An average of 70 per cent. of quinces are infested at the end of September and during October.

Tests were begun in 1937 on the use of spot sprays containing 4 oz. lead arsenate, 3 oz. sodium fluosilicate, or 6 or 8 oz. copper carbonate, each with 100 oz. sugar, in 50 pints water, applied at the rate of about ½ pint per tree, on the eastern and southern sides of *Citrus* trees, at 10-day intervals from 15th or 20th October to 10th December and again from 20th February to 30th March, when the picking season

ended. The percentages of infested fruits were 7·2–10·9 on unsprayed trees, almost the same on those sprayed with lead arsenate, and 0·6–0·8, 2·7–3·5 and 1·6–4·8 on those sprayed with 8 and 6 oz. copper carbonate and with sodium fluosilicate, respectively. The application of the sprays of copper carbonate and sodium fluosilicate resulted in 3–5 per cent. infestation of pears, apples and quinces. They reduced the percentage infestation of apricots from 60 to 3·6–5·7 in the humid section of the Esdraelon in 1938, but severely scorched the leaves, resulting in complete defoliation after 4 applications. Poison baits consisting of pieces of sacking dipped every week in the spray mixtures and hung in the trees were tested on apricot in 1939, but were ineffective as they dried too rapidly.

It is recommended that the spot spray, or in cases of heavy infestation, a cover spray of about 2·6 pints per tree of the stronger copper-carbonate solution should be applied to *Citrus* every 10 days from 15th–20th October until 15th December. Further applications should be made from about 20th February (after the rains) if the infestation is severe, and from mid-March if the fruit is to be kept until after May. Cover sprays should be applied from 1st September until the end of the picking season to mandarin oranges ripening in September–October. Infested fruits should be buried at least 16 ins. deep in the soil and covered with a layer of quicklime.

Silvestri (F.). **La lotta biologica contro le mosche dei frutti della famiglia Trypetidae.** [Biological Control of Fruit-flies of the Family Trypetidae.]—*Verh. 7. int. Kongr. Ent. Berlin 1938* **4** pp. 2396–2418. Weimar, 1939.

The author discusses at some length the work that has been done in various countries on the biological control of *Ceratitis capitata*, Wied., *Dacus* (*Strumeta*) *cucurbitae*, Coq., *D.* (*Daculus*) *oleae*, Gmel., and several species of *Anastrepha*.

The following are his conclusions: Where conditions favour the increase of Trypetids and of their parasites, it is possible to obtain at least a reduction in infestation. Some Trypetids of the genera *Dacus* and *Ceratitis*, such as *D. oleae* and *C. capitata*, are attacked by parasites of other Trypetids, being apparently incapable of phagocytising the larvae. Some species of *Anastrepha* (at least *A. fraterculus*, Wied.) are able to phagocytise parasites of other species, even of the same genus. It is not known whether this ability is permanent or whether it depends on climate or the host-fruit.

Hanna (A. D.). **The Pomegranate Fruit Butterfly** *Virachola livia* **Klug. Morphology, Life-history and Control.**—*Bull. Min. Agric. Egypt* no. 186, [4] 54 pp., 39 pls. (5 col.), 1 map, 38 refs. Cairo, 1939. Price *P.T.* 10.

The cultivation of pomegranates in Egypt has decreased seriously in the last twenty years owing to infestation of the fruits by *Virachola livia*, Klug. This Lycaenid also attacks the fruits of dates, loquat (*Eriobotrya japonica*) and guava, and the green pods of a number of leguminous plants, especially *Acacia nilotica*, which produces pods throughout most of the year, and *A. farnesiana*. Observations showed that the degree of infestation of pomegranates was directly proportionate to the number of *Acacia* trees present, and that pomegranates were

not attacked in oases where no *Acacia* occurred. In Lower Egypt, the percentage infestation of pomegranates is high during July, when the green pods of *A. nilotica* and *A. farnesiana* are scarce, and drops suddenly in August, when *A. nilotica* produces new pods. *Acacia* appears, therefore, to be the chief food-plant of the Lycaenid, and captive females laid more eggs on green *Acacia* pods than on pomegranate fruits.

Descriptions are given of all stages, including the 4 larval instars, and of the anatomy of the female and male reproductive organs and of the larva. Females placed with males in cages measuring 1 or 2 cu. ft. laid no viable eggs, but those placed in muslin field cages of about 6 cu. ft. capacity oviposited on pomegranate fruits and larvae were obtained. The adults were fed on honey solution sprayed 2 or 3 times daily on flowers suspended in the cages. Oviposition usually began 2–3 days after emergence, the eggs being deposited, usually singly, on the surface of the fruit, sometimes on the inner surface of the calyx and rarely on the leaves and branches. Eggs are also deposited on dates and on the pods of the leguminous food-plants. Females dissected in July, 1–6 days after emergence, contained an average of 320 eggs. In winter the ovaries were very short and contained very few mature eggs. Only one larva occurred in a single date and usually not more than one in each pomegranate, though as many as five were observed in highly infested areas. Pupation usually takes place inside the fruits. The durations of the immature stages and of the complete life-cycle, which were dependent on temperature, are shown in graphs ; the egg, larval and pupal stages varied from about 3, 14 and 6 days at 32°C. [89·6°F.] to 10, 50 and 45 at 16°C. [60·8°F.].

On hatching, the larva crawls to a part of the pomegranate where the rind is thin and then burrows into it, but does not ingest the particles that it chews off ; when the burrow is deep, it returns to the surface to reject the skin and then re-enters the burrow until it reaches the seeds, on which it feeds. In the case of dates, it feeds on the flesh and, in unripe ones, on the soft seed, and again rejects the skin. It may migrate from one fruit to another if they are in contact. Most of the infested fruits drop.

About 20 and 2 per cent. of the pupae taken from pods of *Acacia* in the winters of 1935 and 1936 were parasitised by *Brachymeria brevicornis*, Klug. This Chalcid was not observed during the summer. Females oviposit in the pupae of the host about 2 days after emergence ; usually only one egg is laid in each, and if two occur, one of the resulting larvae usually attacks the other.

Control measures are discussed in detail. The eradication of *Acacia* from the neighbourhood of pomegranate plantations is unlikely to prove practicable, except in oases, in view of the local value of the wood, and would, moreover, have to be carried out over considerable areas, since the infestation spreads 4-5 miles in the direction of the prevailing wind. Destroying the eggs by hand throughout the season is too expensive, and covering the fruits in paper bags, which is also expensive, has a deleterious effect on them.

Field experiments on the use of dusts against the larvae on pomegranates were made in 1935, the trees being treated 5 times, at intervals of 15–20 days, beginning on 19th June. Of the dusts tested, Paris green mixed with lime, talc and flour gave the best results, up to 92·3 per cent. of the treated fruits remaining sound. Under Egyptian conditions, however, dusting is more expensive and

more difficult than spraying, and in all further experiments sprays were used.

In 1935, satisfactory results were given by sprays of Paris green (mixed with lime, talc and flour) and sodium fluosilicate (mixed with lime, talc, flour and casein), which were more effective than calcium arsenate or barium fluosilicate in similar mixtures. The addition of an inert carrier, such as Quena mud or talc, very considerably increased the effectiveness of the sprays. Their adhesiveness is increased by the flour, but if too much is added, a paste is formed that prevents the poison from adhering to the mouth-parts and body of the larvae. The casein facilitates the wetting of the waxy surface of the pomegranate. An alkali such as lime is essential in suspensions of sodium fluosilicate to reduce the acidity of the spray, which is injurious to the foliage and fruits, but if added in excess it also reduces toxicity.

The value of Paris green and sodium fluosilicate was confirmed in field trials on a larger scale in 1936, when pomegranates in seven localities were sprayed 5–6 times during the season. The most effective formulae, which gave averages of 91·7 and 90·8 per cent. sound fruits, respectively, were 100 gm. Paris green, 400 gm. lime and 50 gm. flour in 4 gals. water, and 125 gm. sodium fluosilicate, 140 gm. lime, 12 gm. casein, 25 gm. flour and 360 gm. Quena mud in 4 gals. water. Since sodium fluosilicate costs less than Paris green, it was used on a still larger scale in 1937. Of the formulae tested, the most economical and effective was that stated above, with an increase in the proportion of Quena mud to 380–500 gm., and it was successfully applied in different parts of Egypt in 1938. Under ordinary conditions, it did not affect the leaves, stems or fruits.

The sprays should be applied, at intervals of 2–3 weeks, during the period when oviposition occurs on pomegranates owing to the scarcity or absence of the green pods of *A. nilotica*. This period occurs between May and September, but the date on which it begins and its duration vary in different parts of Egypt. In some places, however, the eggs appear on pomegranates earlier than in others, probably owing to the presence of *A. farnesiana*, which is grown in abundance in gardens for ornamental purposes. The sprays are best applied between 10 a.m. and 3 p.m., when, owing to high temperatures, the water evaporates rapidly and leaves a thick film on the fruits, which ensures a high mortality.

Beshir (M.) & Hosny (M.). **Some Mealy Bugs of Egypt and Experiments on their Control by means of Chemicals.**—*Bull. Minist. Agric. Egypt* no. 209, 16 pp. Cairo, 1939. Price *P.T.* 2.

Notes are given, in some cases from the literature, on the bionomics of the mealybugs that are of considerable economic importance in Egypt. They comprise *Phenacoccus hirsutus*, Green, *Pseudococcus citri*, Risso, and *P. filamentosus*, Ckll., which are polyphagous, and *Trionymus* (*P.*) *sacchari*, Ckll., which has become one of the principal pests of sugar-cane. Two other Coccids commonly known as mealybugs in Egypt are included. They are *Icerya aegyptiaca*, Dgl., which is polyphagous, and *I. purchasi*, Mask., which causes considerable damage locally to *Citrus*, but is often accompanied and controlled by larvae of Coccinellids, particularly *Rodolia* (*Novius*) *cardinalis*, Muls.

Characters by which these Coccids can be distinguished are given. Experiments are described in which guava trees were sprayed for the control of *P. hirsutus*, this species being selected for the tests because it is economically the most important and the one that causes the most serious damage to fruit and shade trees. Promising results were obtained with some mineral-oil emulsions and tar-distillates, while nicotine sulphate gave moderate results when soap or penetrol was added to it. Before spraying, crumpled terminal shoots should be cut down and, if possible, burnt on the spot. All parts of the tree and the soil under it should be thoroughly sprayed, using a pressure of not less than 300 lb. Treatment should be made when the mealybugs are immature or in the young adult stage and when the plants are most resistant to oil. Fruit trees should never be sprayed when in flower, and sprays should not be applied when the temperature rises above 30°C. [86°F.] or the relative humidity above 80 per cent. Tar distillates should not be applied in summer and should not be used at all on *Citrus* or other delicate plants.

ATTIA (Rizk) & MATTAR (Bishara). **Some Notes on " The Potato Tuber Moth "** (*Phthorimaea operculella*, **Zell.**).—*Bull. Minist. Agric. Egypt* no. 216, [4] 136 pp., 41 figs., 6 pls., 213 refs. Cairo, 1939. Price *P.T.* 10.

This bulletin is designed to provide growers in Egypt with information on *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., which causes considerable damage to potatoes in different parts of the country. Lists are given of 79 Tineids that have been included in the genus *Phthorimaea*, with references to most of the original descriptions, and of the six species that have been recorded in Egypt. These include *G.* (*P.*) *ergasima*, Meyr., on the leaves of egg-plant (*Solanum melongena*) and *G.* (*P.*) *ocellatella*, Boyd, on leaf-beet (*Beta vulgaris cicla*). The synonymy of *G. operculella* is discussed, all stages are described, its distribution throughout the world and recorded food-plants and parasites are shown in tables and lists, and it is concluded from a survey of the literature on the influence of temperature, rainfall and food on its distribution that Egypt offers particularly favourable conditions for it. In Egypt it is common on potato and egg-plant, and also infests henbane (*Hyoscyamus niger*), but apparently does not attack tomatos, the species found on this crop having recently been identified as *G.* (*P.*) *epithymella*, Stdgr.

An account of the bionomics of *G. operculella* is based on the literature and on field and laboratory observations. In Egypt, it has 9 generations annually, and all stages occur throughout the year. Development is quickest in individuals from eggs laid in June, July and August, and slowest in those from eggs laid in November, December and January. Observations on adult longevity showed that males lived for about 15 days at 18°C. [64·4°F.] and about 4 at 35°C. [95°F.]. At 13°C. [55·4°F.] fertilised females survived for 38–40 days and laid an appreciable number of eggs ; as the temperature rose their longevity decreased. The critical temperature, above which no eggs were laid and the moths died quickly, was about 36°C. [96·8°F.]. Unfertilised females lived longer than fertilised ones, but eggs laid by them did not hatch. The average duration of the oviposition period was 11 days at 13°C., 2·25 at 35°C., and 1·5 at 30°C. The numbers of eggs laid by individual females varied from 3 to 134 and were usually highest at

about 28°C. [82·4°F.]. Eggs are laid on any part of the green plant and possibly on the soil, on stored tubers or the material covering them, or on the walls of storehouses. The minimum temperature at which the eggs hatch is probably between 10 and 15·6°C. [50–60·08°F.]. The average duration of the egg stage varied from 18·1 days at 15·6°C. to 3 days at 31·75–36·1°C. [about 89–97°F.], and that of the larval stage from 64·5 days at 18·3°C. [64·94°F.] to 9·5 days at 35°C. Pupation takes place in cocoons on or near the surface of the soil or on the tubers. The pupal stage is the most resistant to temperature, and ranged from 4 days at average temperatures of 33·5 and 34·1°C. [92·3 and 93·38°F.] to 49 days at 13·1°C. [55·58°F.]. No adults emerged at temperatures below 13·1°C. or above 40°C. [104°F.].

Control measures are reviewed in some detail from the literature.

Colony and Protectorate of Kenya. Plant Protection Ordinance, 1937. 6 pp. Nairobi, 1937. Government Notices 687 and 688 of 1937, 851 of 1938, 468, 551 and 970 of 1939, 127 of 1940.

By the Plant Protection Ordinance of 1937, the Governor in Council may make rules designed to prevent or control attacks by or the spread of pests or diseases of plants in the Colony of Kenya, and the Governor may, by order, prohibit or regulate the import and export of any plants and articles, whether of a nature similar to plants or not, and of any animals likely to infect any plant with any pest or disease. In this ordinance, disease means any abnormal condition of plants believed to be communicable by the transfer of a causative agent or by the propagation of the affected plant that the Governor may, by order, declare to be a disease, and pest means any animal or vegetable organism injurious to plants or plant products and any other agent capable of producing a communicable disease of plants that the Governor may, by order, declare to be a pest. Subsequent Orders (Government Notices nos. 687 of 1937 and 127 of 1940) contain schedules including 37 and 2 species, genera or groups of insects that are declared to be pests.

By other Orders (Government Notices nos. 688 of 1937, 851 of 1938 and 468 and 970 of 1939), the importation into the Colony of plants or parts of plants (including fruits and, with certain exceptions, seeds) is forbidden except under permit and under specified conditions. The Director of Agriculture may require imported plants to be detained in quarantine or in approved places. The importation of fruit trees and fruit grown in or consigned from Japan, China, Korea or Manchuria, of any plant or part of a plant of the order Gramineae (except seeds) intended for use as fodder, and of any rooting medium for plants that consists either wholly or in part of soil, whether or not it is attached to a plant, is prohibited. No living insects or other invertebrate animals in any stage may be imported except under permit.

By the Plant Protection Rules, 1939 (Government Notice no. 551 of 1939), provision is made for prohibiting the movement within the Colony of any plant or seed that is diseased or likely to spread disease, and for prohibiting for any period the planting or growing of any crop likely to favour any disease or pest. The occurrence of any pest or disease shall be reported by the occupier or owner of land, and specimens of the pest or diseased plant sent. An inspector may give instructions for the treatment of any building, vehicle, aircraft or vessel

suspected of being or having been used for the storage or conveyance of anything likely to infect any plant with a disease or pest, and for controlling or destroying any plant that has been declared to be a pest. The movement of specified plants from areas declared to be infected can be prohibited. Areas in which a close season for maize is to be enforced are defined. If any coffee is found to be infested with an insect pest in a warehouse or coffee curing and cleaning factory, the fact shall be notified and the treatment of the bags containing the infested coffee and any coffee in contact with it may be ordered. All loose coffee on or near any place where coffee may be spilled shall be collected and roasted or burnt. Oviposition by locusts and the appearance of hoppers must be reported, and the measures recommended by the inspector for the destruction of eggs, hoppers or flying locusts adopted. No person shall permit hoppers to be driven on to his neighbour's land.

LOUGHNANE (J. B.). *Myzus ornatus* **a Vector of Potato Viruses.**—*Nature* **144** no. 3653 pp. 785–786. London, 1939.

Tests were carried out to ascertain the efficiency as a vector of potato viruses of *Myzus ornatus*, Laing, which was found feeding on clover plants in a glasshouse near Dublin in 1932 and has since been recorded on a wide range of food-plants including potato [*cf. R.A.E.*, A **26** 527]. Leaf roll [**26** 47] and virus Y [**20** 63] were transmitted by this Aphid to 10 out of 16 and 5 out of 16 potato plants, respectively. Negative results were obtained with virus X [**20** 63] and virus A [**21** 428]. *M. ornatus* has been found only to a very slight extent feeding on field crops of potatoes in Eire and is therefore unlikely to be important as a vector of potato viruses, but in view of its wide range of food-plants, it probably transmits viruses of other crops.

CAIRASCHI (E. A.). **Sur les dégats et les déformations des rameaux provoqués par les** *Yezabura* **Mats. (Hem. Aphididae) sur les pomacées cultivées.**—*Rev. Path. vég.* **26** fasc. 2 pp. 124–137, 4 figs. Paris, 1939.

The author discusses the scope and synonymy of the genus *Yezabura* which he considers distinct from, though closely allied to, *Anuraphis*. Apples in France are attacked by Aphids of this group, though it is uncertain whether more than one species, *Anuraphis roseus*, Baker (*Y. malifolii*, auct.), is concerned. In spring, the Aphids, which migrate in June to various herbaceous plants, develop on the leaves and young branches of apple, a generation being completed in 10–15 days. In the case of early varieties, the chief form of attack is by groups of apterous individuals on the lower surfaces of the leaves, which they cause to roll. On later ones, more serious injury is caused to the branches, on which the Aphids gather in colonies that move from one spot to another. Growth of very young branches is noticeably retarded. More advanced ones become distorted, infested trees have a bushy appearance and pruning is made difficult. A study of the affected tissue showed that the Aphids leave a sheath in it [*R.A.E.*, A **28** 75, etc.] at the end of which is a gall that is corky in character.

Galls are also formed on the surface. The Aphids never develop on the roots. The action of the saliva is discussed. It is probably similar to that of the saliva of other Aphids and Psyllids [*loc. cit.*].

Trouvelot (B.) & Brejoux (R.). **Rapports biologiques entre le doryphore (*Leptinotarsa decemlineata* Say) et *Solanum demissum* 2e note). Somnolence et réduction d'activité présentées par les larves consommant les feuilles de cette plante.**—*Rev. Path. vég.* **26** fasc. 2 pp. 142–147, 2 figs. Paris, 1939.

Investigations were carried out on the loss of appetite and the immobility shown by larvae of *Leptinotarsa decemlineata*, Say, on *Solanum demissum* and the dependence of these reactions on a direct and specific action of the plant [*cf. R.A.E.*, A **27** 169, 357, etc.]. The amount of food consumed by fourth-instar larvae placed on *S. demissum* var. *xitlense* and kept under observation for two hours and the duration of the feeding period were about 12 per cent. of the corresponding values for larvae fed on potato (*S. tuberosum*), and the periods of immobility lasted about twice as long. Larvae artificially under-fed on potato moved about continually, however, except during the short periods of feeding, and when allowed to remain on potato, began to feed immediately. Immobile larvae from *S. demissum* transferred to potato did not begin to feed for $\frac{3}{4}$–$2\frac{1}{2}$ hours if they had eaten 5–6 sq. mm. of leaf and 4–5 hours if they had eaten 7–8 sq. mm. Periods of feeding on *S. demissum* are usually short, and the larvae may cease feeding before they have absorbed enough to cause these physiological disturbances. It is therefore considered that the larvae are affected by *S. demissum* in two ways; they find it distasteful, and they suffer from a form of poisoning characterised by deep but temporary disturbance if they eat a certain quantity of foliage in a short time. The taste reaction varied in different larvae and according to the botanical forms of *demissum*. When the plant is distasteful enough to prevent the rapid absorption of quantities sufficient to bring about long periods of torpor, but not to prevent fairly rapid and regular resumption of attack, a considerable amount of food is consumed each day; the development of the larvae that have eaten most is always the least retarded. It is therefore considered that the duration of the feeding period indicates the degree to which a plant is distasteful, that the relation between the quantity of leaf eaten in a short time and the duration of torpor is a measure of its toxicity, and that the reduction in total daily feeding determines, to a great extent, its inability to support normal larval development. On hybrids of *S. demissum* and potato, the same characters of larval behaviour are found, but with varying intensity that always corresponds to the degree of resistance of the plants.

Nepveu (P.). **Contribution à l'étude d'*Hydroecia xanthenes* Germ. noctuelle nuisible aux cultures d'artichaut.**—*Rev. Path. vég.* **26** fasc. 2 pp. 163–168, 1 fig., 4 refs. Paris, 1939.

An account is given of the results of uncompleted studies of the bionomics of the Noctuid, *Hydroecia xanthenes*, Germ., which is a serious pest of globe artichokes, made because its life-history as observed in south-eastern France in 1938 differed considerably from that recorded by de Stefani in Sicily [*R.A.E.*, A **13** 58]. In the neighbourhood of Antibes, the adults are present at the end of September

and in October [**8** 213 ; **25** 68]. The females, which are thought to live about a fortnight, lay their eggs in batches of 50–400 at the base of artichoke plants in dried leaves or cracks, or along the veins on the inner surface of the leaves. Scales from the female's wing, débris and particles of earth adhere to the egg-masses and sometimes make them difficult to discern. Oviposition appears to be stimulated by irregularity of the sub-stratum and minuteness of the holes into which the ovipositor is introduced by the female. If an artichoke leaf is pierced by small holes, eggs may be laid through them on the opposite side of the leaf. The eggs and first- and second-instar larvae are described. Eggs laid during October and placed immediately in an incubator at 25–27°C. [77–80·6°F.] desiccate in a dry atmosphere or go mouldy in a damp one in about a fortnight, but similar eggs left out-of-doors under shelter for the winter and placed in the incubator on 20th January all hatched in one week in a damp atmosphere. Apparently, eggs normally hatch about the end of February and the beginning of March on the south-eastern coast of France. The newly hatched larvae are very active. On reaching the artichoke leaves, they feed very slightly on either surface and then attack the secondary veins on the inner surface, often at the junction with the main vein, and usually enter them within 5 or 6 hours. On an older plant, the larvae sometimes enter through a tertiary vein. They proceed to the main vein and thence to the petiole, leaving plugs of excrement in the mine. It has not been determined whether the peduncle is reached through the interior of the plant, or whether the larva leaves the petiole and later enters the peduncle. Whatever the number of young larvae placed on a plant, more than one second-instar larva was never observed in one petiole.

VAN POETEREN (N.). **Verslag over de werkzaamheden van den Plantenziektenkundigen Dienst in het jaar 1938.** [Report on the Work of the Phytopathological Service in 1938.]—*Versl. PlZiekt. Dienst Wageningen* no. 93, 92 pp., 4 pls. Wageningen, 1939.

Many of the pests recorded in Holland in 1938 have been noticed from previous reports [*R.A.E.*, A **27** 269, etc.]. Severe local infestation of fescue grass, chiefly *Festuca arenaria* and *F. rubra*, by *Pediculopsis graminum*, Reut., was observed ; no seed was produced by the infested ears. The value of dusting with derris against *Malacosoma neustria*, L., on trees in Amsterdam [**26** 529] was confirmed. In continuation of work on the control of *Chermes* (*Gilletteëlla*) *cooleyi*, Gill., on Douglas fir [*Pseudotsuga taxifolia*] in 1934 [*cf.* **23** 718], 15 sprays, chiefly preparations of mineral oils, were tested in July. Examinations were made after a few weeks and in May 1939. In both examinations, no living Aphids were observed on trees sprayed with Summer Volck at 1 per cent., and very few on those treated with some of the other oil emulsions or a standard spray of nicotine and soap. Spraying in August gave very inferior results. Preliminary investigations indicated that some protection against *Psila rosae*, F., was afforded to carrots by sowing onions between the rows, but it is not known whether this repellent effect would persist in the absence of other opportunities for oviposition. *Leptinotarsa decemlineata*, Say, on potato was recorded from 161 communes during 1938 [*cf.* **27** 63]. A list of the insecticides and fungicides tested during the year is given, with notes on the results obtained.

MARIE (V.). **El cultivo del algodonero en el Valle de Cañete, en relación con las plagas entomológicas, en 1939.** [The Cultivation of Cotton in the Cañete Valley in Relation to Insect Pests in 1939.]—*Inf. Estac. exp. agríc. La Molina* no. 51, 31 pp. Lima, 1939.

In view of the severe infestation by insect pests of cotton in the Cañete Valley, Peru, investigations were carried out in 1939 by J. E. Wille and W. Weyrauch, and the various reports submitted by them in the course of the year are here reproduced.

The chief pest in this district is usually *Anomis luridula*, Gn. (*texana*, Riley), which is successfully controlled by dusts of lead or calcium arsenate, but during the past three years infestation of the bolls by *Heliothis virescens*, F., and *Mescinia peruella*, Schaus, has assumed serious proportions. Other pests observed in 1939 were *Anthonomus vestitus*, Boh., *Aphis gossypii*, Glov., and an undescribed Jassid. Lists are given showing the percentage infestation of cotton by these pests in various localities. *A. gossypii* was kept in check by predacious Coccinellids and Chrysopids, and by the Braconid, *Aphidius phorodontis*, Ashm., which were not harmed by early applications of an arsenical and were favoured by strong sunshine and high temperature. Ratoon cotton is commonly grown in this region, and cultivation of the soil, which necessarily involves its destruction, is recommended against *H. virescens*. At the end of March, infestation had spread from ratoon to plant cotton, of which up to 80 per cent. of the bolls formed in January and February were infested. No effective natural enemies were present. It was observed in laboratory and field observations that chick pea [*Cicer arietinum*] was a preferred food-plant of *H. virescens* and that cotton growing near it was practically uninfested. Growers were therefore advised to plant small plots of chick pea among cotton to attract ovipositing females, and to spray them with an arsenical as soon as the eggs hatched. Observations in October showed that oviposition was heavy on such plots and that the young larvae were successfully controlled by a spray of 0·5 per cent. lead arsenate and 0·5 per cent. lime applied at intervals of 10–15 days. It was recommended that the pods should be collected and destroyed as soon as they formed, to prevent the larvae from entering them. Cotton in the neighbourhood of chick pea was not infested.

KOSTRITXKY (L.). **El empleo de los microbios en la lucha contra los insectos nocivos a la agricultura.** [The Use of Micro-organisms in combating Insect Pests of Agriculture.]—*Bol. Direcc. Agric. Ganad. Peru* **9** (1938) no. 28–31 pp. 81–88, 1 pl. Lima [1939].

After a brief historical note on the use of fungi and bacteria against injurious insects, the author gives an account of work in Peru with dry spores of various virulent bacteria obtained from Europe. The names of these bacteria are not given. In the laboratory, Noctuid larvae attacking cabbages and other vegetables all died within 4–5 days after feeding on cabbages and other vegetables contaminated with the bacteria and in 24 hours after being inoculated with them. Following these and other laboratory tests, a number of experiments were made in the field. Complete mortality of larvae of *Ascia* (*Pieris*) *monuste*, L., on cabbage was given in 48 hours by a single application of a suspension of spores of bacteria that had been dry for several months. On the treated plants, feeding ceased within 24 hours,

whereas it continued on the control plants and the number of larvae on them increased. In tests against *Diatraea saccharalis*, F., and *Laphygma frugiperda*, S. & A., on maize, considerable mortality was given by two applications of a weak suspension, although many of the larvae had already entered the stalks. The numbers of ears that developed on treated and untreated plots were 102 and 34, and of the latter all were in poor condition. In a comparative test on cabbage, bacteria gave better control of insect pests than arsenicals. The action of the bacteria on the larvae of insects is described.

WILLE (J. E.). **Informes del Departamento de Entomología de la Estación Experimental Agrícola de la Molina.** [Reports of the Department of Entomology of the La Molina Agricultural Experiment Station.]—*Bol. Direcc. Agric. Ganad. Peru* **9** (1938) no. 28–31 pp. 169–174. Lima [1939].

In 1937, *Hippodamia convergens*, Guér., was imported into Peru from California and released against Aphids on *Citrus* and cotton. The Coccinellid failed to establish itself, apparently owing to the moist climate, but the closely allied species, *Cycloneda sanguinea*, L., was abundant and gave good control of the Aphids.

The rust mite, *Phyllocoptruta* (*Phyllocoptes*) *oleivorus*, Ashm., has been found to be the cause of injury to oranges in the region of Guayaquil; the damage was previously thought to be due to fungous infection. Dusting with sulphur or spraying with lime-sulphur is recommended against it.

JACOBY (M.). **A renovação do oxigênio no ninho da *Atta sexdens* L.** [The Replenishment of Oxygen in the Nest of *A. sexdens*.]—*Bol. Minist. Agric. Brasil* **28** pp. 1–7, 2 figs., 4 refs. Rio de Janeiro, 1939.

In connection with work on fumigation against the leaf-cutting ant, *Atta sexdens*, L., which is a serious pest in Brazil [*R.A.E.*, A **23** 663], the author investigated the manner in which the supply of oxygen to the nest is renewed. During the night, or at other times when the temperature of the outer air is less than that of the soil (24°C. [75·2°F.]), fresh air sinks through the peripheral passages to the bottom of the nest and displaces the warmer used air, which flows out through the central passages. This process continues until morning when the sun warms the outer air until it exceeds 24°C.

ARAUJO (R. L.). **Duas pragas do abacateiro.** [Two Pests of Avocado.] —*Biologico* **5** no. 10 pp. 231–232. S. Paulo, 1939.

Descriptions are given of the Pyralid, *Stericta albifasciata*, Druce, and the Tineid, *Stenoma catenifer*, Wlsm., both of which infest avocado [*Persea gratissima*] in Brazil. The larvae of *S. albifasciata* are gregarious and feed in nests of leaves and twigs spun together with silk. The larval and pupal stages last about 27 and 17 days. Infested twigs should be cut off and burned, and a spray of lead or calcium arsenate should be applied. Females of *S. catenifer*, which is apparently restricted to avocado, oviposit on young fruits, and the larvae bore into them and feed on the seeds, causing the fruits to drop. Pupation occurs in the soil. All infested fruits should be collected and burnt

or buried. It is suggested that a spray of Bordeaux mixture containing an arsenical would control the larvae and fungi; it should be applied when the fruits attain the size of an orange.

Forster (R.) & Costa (A. S.). **Nota preliminar sobre a molestia "vira-cabeça," do fumo.** [Preliminary Note on the "Crooked Top" Disease of Tobacco.]—*Bol. tech. Inst. agron. Campinas* no. 38, 12 pp., 4 pls., 5 refs. Piracicaba, 1938; also in *Rev. Agric.* **13** no. 1–2. S. Paulo, 1938. (With a Summary in English.) [Recd. 1940.]

Costa (A. S.) & Forster (R.). **A transmissão mecânica de "vira-cabeça" por fricção, com suco.** [The mechanical Transmission of Crooked Top by Friction, with Sap.]—*Bol. tech. Inst. agron. Campinas* no. 50, 15 pp., 6 pls., 13 refs. S. Paulo, 1939. (With a Summary in English.)

Costa (A. S.) & Kiehl (J.). **Uma moléstia da batatinha—"necrose do tôpo"—causada pelo virus de "vira-cabeça."** [A Disease of Potato, Top Necrosis, caused by the Virus of Crooked Top.]—*Jorn. Agron.* **1** no. 3 pp. 193–202, 3 pls., 4 refs. S. Paulo, 1938. (With a Summary in English.)

In the first paper, a detailed description is given of the symptoms of a virus disease known as vira-cabeça, or crooked top, that is becoming increasingly common in tobacco in São Paulo, Brazil. All varieties of *Nicotiana tabacum* are affected, and also *N. rustica* and a variety of *N. triplex*, but *N. glauca* is apparently resistant. The stems and leaves of affected plants become stunted and twisted, a yellowish discoloration sets in, and death commonly ensues. A few plants occasionally recover. Experiments on the transmission of the virus to healthy tobacco (*N. tabacum*) were made with *Dicyphus* sp., an Aphid, probably *Aphis gossypii*, Glov., and *Frankliniella* sp., all of which are common on tobacco in the field, but only the last-named gave positive results, four plants showing typical symptoms 9–10 days after the infected thrips were transferred to them. The virus was transmitted by grafting to tobacco and tomato, but not to potato.

In the second paper, it is stated that the symptoms of crooked top of tobacco most nearly resemble those of kromnek [*R.A.E.*, A **21** 583], and investigations are recorded showing that the virus was transmitted by mechanical methods from infected tobacco to tobacco and tomato, and from tomato to tomato and tobacco.

In the third paper, the authors state that healthy potato plants in pots in a room that also contained tobacco plants infected with crooked top and heavily infested by *Frankliniella* sp. developed symptoms of a form of top necrosis that was also observed to occur in the field. The symptoms in potato are briefly described. In experiments, thrips from infected tobacco transmitted the disease to potato, and it was transmitted by mechanical methods between potato, tobacco and tomato. It is concluded that the virus of this form of top necrosis is the same as that of crooked top, and that *Frankliniella* sp., which is common in potato fields, is a vector of it.

Lepage (H. S.). **Inimigos do milho armazenado.** [Pests of stored Maize.]—*Biologico* **5** no. 11 pp. 243–249, 4 figs. S. Paulo, 1939.

The most important pests of stored maize in São Paulo, Brazil, are *Calandra* (*Sitophilus*) *oryzae*, L., and *Sitotroga cerealella*, Ol., the

bionomics and morphology of both of which are briefly described. *C. oryzae* has about 7 generations a year in the State as a whole, and 8 in Santos. *S. cerealella* has from 6 to 8. The usual method of control adopted is fumigation with carbon bisulphide.

MORRISON (H.). **Taxonomy of some Scale Insects of the Genus *Parlatoria* encountered in Plant Quarantine Inspection Work.**—*Misc. Publ. U.S. Dep. Agric.* no. 344, 34 pp., 11 pl., 56 refs. Washington, D.C., 1939.

Some species of *Parlatoria* are serious pests of *Citrus* in various parts of the world, and others have been recorded as injuring rosaceous fruit trees. The frequency with which some species are encountered on plant material entering the United States from foreign countries suggests that the economic importance of the genus has increased owing to the spread of its members to new localities and new food-plants. This paper is designed to modify certain published, but apparently incorrect, synonymy among species of the genus, to call attention to some new synonymy that needs recognition, to increase the available knowledge on the distribution and food-plant relationships of the 12 species discussed, and to present information and illustrations to aid in the recognition of these species. The genus *Parlatoria* is used in the currently accepted rather broad sense, and no attempt is made to establish sub-groups or to form opinions on various published proposals to place some of these species in other generic units. The structural characters considered are discussed, and a key to the species dealt with is appended. Most of the information comes from a study of specimens in the United States national collection of Coccidae, and the loan of type specimens of *P. cinerea*, Hadden, by G. F. Ferris has cleared up confusion respecting this species. It has been credited in the past both to Doane & Hadden and to Cockerell & Hadden, but the introduction to the paper in which the original description appeared shows that the true author is Hadden only. It has been recorded in the literature under the manuscript name of *brasiliensis* [**10** 276], and *P. fluggeae* var. *brasiliensis*, Costa Lima [**23** 165] and *P. pseudopyri*, Kuwana & Muramatsu [**20** 274] are synonyms of it. Unpublished records of collections and especially of plant-quarantine interceptions indicate that it is polyphagous and very widely distributed on *Citrus*. *P. theae viridis*, Ckll., and *P. t. euonymi*, Ckll., are not considered to be even varietally distinct from *P. theae*, Ckll., but *P. camelliae*, Comst., and *P. crotonis*, Dgl., are regarded as distinct from *P. pergandei*, Comst., and *P. proteus*, Curt., respectively.

PAUL (L. C.), KING (K. M.) & PUTNAM (L. G.). **Summary of Saskatchewan Grasshopper Infestations, Autumn 1939 and Ratings of probable Outbreaks 1940.**—*Saskatoon Leafl. Dep. Agric. Canada* no. 55, 14 pp., multigraph, 1 fldg col. chart. Ottawa, 1940.

This is a summary of a survey similar to those carried out in previous years [*cf. R.A.E.*, A **27** 543, etc.]. A new feature is a map of infestation ratings, published in addition to the general forecast map. An important development in 1939 was a decrease in numbers of *Camnula pellucida*, Scudd., mainly owing to heavy precipitation in June and high mortality from *Empusa*, which affected other species to a less degree.

Melanoplus mexicanus, Sauss., *M. packardi*, Scudd., and *M. bivittatus*, Say, were also reduced in numbers. The prospect for 1940 is a much reduced infestation over most of Saskatchewan as compared with 1939.

Paul (L. C.) & Fox (W. B.). **The Distribution of the Mormon Cricket, *Anabrus simplex* Haldeman, in Saskatchewan.**—*Canad. Ent.* **71** no. 9 pp. 202–204, 1 fig. Guelph, 1939.

The distribution of *Anabrus simplex*, Hald., in Saskatchewan, where it has increased both in abundance and distribution in recent years, particularly in 1938, is shown on a map based on records made from 1924 to 1938, inclusive. Single records, all from the southern part of the Province, were secured in five of the years 1924–31, and five records, four from the south-central part of the province, in 1932. In the following year, there were twelve widely distributed records, all from the prairie area except one, the most northerly secured, from about 260 miles north of the International Border, and further increases were observed in 1934. Fewer records were obtained in the following three years, but distribution extended farther into the park belt. There were 35 records in 1938, extending over the whole prairie area and into the park belt almost to the heavily wooded territory. The distribution of *A. simplex* in Saskatchewan is closely correlated with the abundance of grasshoppers in the area. It is not anticipated that control measures will be necessary in 1939, there being no confirmed reports of damage to crops.

Maxwell (C. W. B.). *Lampronia rubiella* **Bj., an European Raspberry Pest new to North America.**—*Canad. Ent.* **71** no. 9 p. 204. Guelph, 1939.

Larvae found infesting the leaf-buds of raspberry in New Brunswick in May 1936 were reared, and the adults were identified in 1938 as *Incurvaria* (*Lampronia*) *rubiella*, Bjerk. This is the first record of this Tineid from North America.

Hough (W. S.). **Dormant and Delayed Dormant Sprays for the Control of Rosy Apple Aphids and Scale Insects.**—*Bull. Va agric. Exp. Sta.* no. 322, 31 pp., 8 figs., 5 refs. Blacksburg, Va, 1939.

This bulletin contains a summary of the results of field studies carried out during 1926–38 on the control of *Anuraphis roseus*, Baker, *Aspidiotus* (*Quadraspidiotus*) *perniciosus*, Comst., *A.* (*Q.*) *forbesi*, Johnson, and *Chionaspis furfura*, Fitch, on apple in Virginia by means of dormant and delayed dormant sprays, together with brief accounts of the seasonal history of each insect and descriptions of the insecticides used and of their physical characters. The results of the experiments are shown in tables.

The following is based on the author's summary : The effectiveness of dormant and delayed dormant oil sprays was decreased by spraying with the wind when a strong wind was blowing, by mixing and applying sprays when the temperature was low (35–45°F.), by inadequate emulsification and consequent dispersion of oil in the spray water, and by the use of excessive amounts of emulsifier. Factors that favoured the effectiveness of the sprays were quiet atmospheric

conditions, low humidity, and mild or warm weather at the time of application. Efficient agitation in the spray tank was essential for all home-made and tank-mixed emulsions.

The physical and chemical characters of the petroleum oils varied, but there did not appear to be any consistent difference in the insecticidal efficiency of the oils with viscosities above 100 Saybolt. A paraffin-base oil having a viscosity of 81–84 Saybolt and a higher evaporation rate than heavier oils was usually the least effective of the oils used against *Aspidiotus perniciosus* and *A. forbesi*. In home-made or tank-mixed emulsions some of the medium-heavy and heavy petroleum oils (viscosity 150–155 and 220–255 Saybolt, respectively) gave control inferior to that given by medium oils within the viscosity range of 105–120 Saybolt. The heavier oils were more difficult to emulsify and separated more readily when diluted in the spray tank.

Dormant sprays containing 3 per cent. petroleum oil and 2·5 per cent. tar oil were effective in controlling all four species. Dormant sprays applied in March, containing approximately 2–2·2 per cent. oil and dinitro-ortho-cyclohexylphenol dissolved in the oil or mixed with the emulsifier and used at the rate of about 7½–11½ oz. per 100 U.S. gals. diluted spray, were effective in controlling *Anuraphis roseus*, *Aspidiotus perniciosus* and *A. forbesi*, but against severe infestations of *C. furfura* it was necessary to increase the oil content to 4 per cent. Dinitro-o-cyclohexylphenol used alone at the rate of 7½–8 oz. per 100 U.S. gals. was less effective against *Anuraphis roseus* (84–86 per cent. control) than sprays in which it was used with oil. Mixtures of lauryl rhodanate (lorol thiocyanate) and petroleum oil were effective in controlling *A. roseus* and the scales, but the thiocyanate scorched the fruit buds at all concentrations used (0·2–0·8 per cent.).

Dinitro-o-cresol (2½ lb. per 100 U.S. gals.), converted to sodium dinitro-o-cresylate in the spray tank by the addition of equal amounts of sodium carbonate and dinitro-o-cresol when it was partly filled with water, and used in a 3·6 per cent. dormant oil spray was effective in controlling *A. roseus* in 1930.

The most effective delayed dormant spray against *A. roseus* was one containing 3 per cent. oil and 0·4 per cent. tar oil. Other delayed dormant sprays, in order of decreasing effectiveness, contained 2 gals. lime-sulphur and 1 pint nicotine sulphate per 100 gals.; 3 per cent. oil and 1 pint nicotine sulphate per 100 gals.; 3 per cent. oil and 0·5 per cent. cresylic acid; and petroleum oil (3 per cent.) used alone [*cf. R.A.E.*, A **24** 473].

Data based on the examination of the numbers of scales that survived through the summer following applications in spring or winter of winter-strength lime-sulphur indicated that this was effective against *Aspidiotus perniciosus* and *A. forbesi* [*cf.* **18** 70]. It was not effective against *C. furfura*. The addition of 2 per cent. lime-sulphur to an oil spray did not consistently increase its effectiveness against *A. forbesi*, although a slight increase in effectiveness against *A. perniciosus* was observed.

The percentage control of *C. furfura* given by 4 per cent. petroleum oil varied from 63 to 100 and averaged 87. The best control was obtained in late March, when favourable weather conditions prevailed at the time of spraying. When a wettable form of dinitro-o-cyclohexylphenol was added to the oil at the rate of 8–9·8 oz. per 100 U.S. gals., the percentage control of *C. furfura* varied between 99 and 100 in three tests made under favourable weather conditions in late March.

Wood creosote at 6·1 per cent. gave only 63 per cent. control of *A. perniciosus* in 1934. Combined sprays containing 1·6–2·2 per cent. tar oil and 0·6–0·8 per cent. paraffin wax gave only 57–68 per cent. control of *C. furfura*, whereas one containing 3 per cent. petroleum oil and 2·5 per cent. tar oil applied at the same time gave 100 per cent. control.

Bailey (S. F.). **Thrips of economic Importance in California.**—*Circ. Calif. agric. Exp. Sta.* no. 346, 77 pp., 40 figs., 4 pp. refs. Berkeley, Calif., 1938. [Recd. 1939.]

An introductory account is given of the general biology of thrips and the injury they cause, and the bionomics and control of the species attacking economic plants in California are described, the amount of information on each species varying with its importance. Much of the information is based on the literature, and a bibliography for each species is appended. A key to the species of economic importance and a table showing available data on their life-histories are included. The principal species (and the crops to which they cause most damage) comprise: *Taeniothrips inconsequens*, Uzel, on pear and prune [*cf. R.A.E.*, A **23** 22]; *Frankliniella* spp. on nectarine, plum, peach, lucerne, peas and ornamental flowers [*cf.* **21** 604, **24** 173]; *Hercothrips fasciatus*, Perg., on beans, pears and cotton [*cf.* **26** 128]; *Scirtothrips citri*, Moult., on *Citrus* [*cf.* **27** 432, etc.]; *Thrips tabaci*, Lind., on onion, carnation and rose; *Taeniothrips simplex*, Morison, on *Gladiolus* [*cf.* **24** 248]; *Heliothrips haemorrhoidalis*, Bch., on *Citrus*, avocado and many greenhouse and ornamental plants; and *Drepanothrips reuteri*, Uzel, on grapevine.

Of the newer insecticides tested against thrips, a spray containing 0·75 per cent. rotenone and 1 per cent. oil has given good control of *T. inconsequens*, which has only one generation a year, and of *H. fasciatus* on pears, but has proved less satisfactory against *Frankliniella* on plums and peaches. Rotenone dusts are in general inferior to sprays, which have greater penetrating power, but are recommended against *Frankliniella* on annual crops. Sprays containing 0·2 per cent. pyrethrins and a spreader have given good experimental results against *Frankliniella* and *T. inconsequens*, and a pyrethrum dust (0·1–0·2 per cent. pyrethrins) at 30 lb. per acre has also been found effective against these species. Other recommendations for the control of *Frankliniella* include the removal of the cover crop and weeds round the orchard at least 2 weeks before the trees blossom, and the application of an insecticide when 75 per cent. of the petals have fallen and again 6–7 days later if necessary. On *Gladiolus* in greenhouses a 2 per cent. thiocyanate spray has proved one of the most effective insecticides tested against this thrips, and on nursery stock a spray of 75 lb. molasses, 4 lb. basic lead arsenate and 8 oz. casein spreader per 100 U.S. gals. water has so far given the best results, although control is still far from satisfactory.

Good results against *Hercothrips fasciatus* on pear have been given by a spray of 1½–2 gals. summer oil and ½–1 pint nicotine sulphate per 100 gals. water applied in mid-July and again after the fruit is picked if severe premature defoliation occurs. Since the migration of *T. simplex* is facilitated by a strong prevailing wind, planting gladioli with the earliest varieties at the leeward end of the field will considerably retard the infestation of later-flowering varieties. Thorough

watering every day or two will reduce the numbers of thrips. *Heliothrips haemorrhoidalis* is effectively controlled in greenhouses by fumigation with ¼–½ oz. calcium cyanide per 1,000 cu. ft., by nicotine dust and by thiocyanate and pyrethrum sprays. Two applications of a spray of 1½ U.S. gals. highly refined light-medium oil (70 per cent. viscosity), 1 U.S. pint nicotine sulphate, 1 lb. casein spreader and 100 U.S. gals. water gave good control of this thrips on avocado.

Porter (C. E.). **Notas breves de entomologia agrícola.**—*Rev. chil. Hist. nat.* **42** pp. 171–172. Santiago, 1938. [Recd. 1940.]

These records of insect pests in Chile include *Agromyza signata*, Mg., on tomato and potato, and *Saissetia oleae*, Bern., on *Abutilon*.

Fonseca (J. P.) & Araujo (R. L.). **Informações sôbre a praga das cigarras em S. Paulo e sôbre as possibilidades de seu combate.** [Information on Cicadid Pests in São Paulo and on the Possibilities of controlling them.]—*Biologico* **5** no. 12 pp. 285–291, 2 pls. S. Paulo, 1939.

Outbreaks of Cicadids on coffee in various parts of the State of São Paulo, Brazil, occurred in 1900–04, 1905, 1910–11 and 1931. The five species observed have already been noticed [*R.A.E.*, A **23** 364]. In 1939, coffee in several localities was severely attacked by a sixth species, *Quesada gigas*, Ol. ; in some plantations as many as 52 larvae were observed down to depths of 18 ins. on the roots of plants 10 years old. They sucked the roots and formed cavities in the soil, which became wet with their excreta for some distance round infested roots. Wounds formed in the roots as a result of their feeding became infected by disease organisms, and the plants gradually became unproductive.

Very little is known about the life-cycle of these Cicadids or the plants on which they occur in nature. Some of them apparently have a developmental period of 3–4 years. The eggs are laid in the bark of the shoots, and the larvae, which hatch in a few days, drop by a thread to the ground. As a rule, coffee is not attacked until it is 10 years old, and the type of soil apparently exercises little influence on infestation. The lines on which the bionomics and control of these pests should be investigated are summarised.

Viégas (A. P.). *Empusa dysderci* **n. sp., um novo parasita de** *Dysdercus*.—*Jorn. Agron.* **2** no. 4 pp. 229–258, 1 fig., 3 pls., 18 refs. Piracicaba, 1939. (With a Summary in English.)

A description is given, in Latin and Portuguese, of *Empusa dysderci*, sp. n., observed in São Paulo, Brazil, parasitising laboratory broods of *Dysdercus mendesi*, Blöte, *D. ruficollis*, L., *D. honestus*, Blöte, and *D. longirostris*, Stål, all of which appeared equally susceptible to infection by it [*cf. R.A.E.*, A **27** 86]. It is apparently restricted to the genus *Dysdercus*, and species of the closely allied genus *Euryophthalmus* were not attacked. In the author's experiments, the eggs of *D. mendesi* and *D. ruficollis*, the species mostly used, were immune from infection by conidia of the fungus obtained from infected bugs. Nymphs in the first instar were fairly susceptible, but resistance increased with age and was greatest in the adults. The development of the fungus in the host is described.

Puzzi (D.). **Valor do parasitismo da *Prorops nasuta* Waterston no combate à bróca do café.** [The Value of Parasitism by *P. nasuta* in Work against the Coffee Berry Borer.]—*Jorn. Agron.* **2** no. 4 pp. 259–264, 8 refs. Piracicaba, 1939. (With a Summary in English.)

The author summarises factors that render *Prorops nasuta*, Wtstn., of value as a parasite of the coffee berry borer, *Stephanoderes* [*hampei*, Ferr.] in Brazil and compares the rate of multiplication of the Bethylid with that of its host. Unpublished observations by Pinto da Fonseca, A. A. Toledo and the present author in São Paulo have shown that on continuously warm days when the temperature reaches 29–32°C. [84·2–89·6°F.] at 3 p.m., females of *P. nasuta* lay 1–2 eggs per day, but that in cooler weather oviposition is less regular. On an average, females that survive for over 90 days deposit over 40 eggs. The durations of the egg, larval, and prepupal and pupal stages were 1–4, 3–6 and 13–26 days, the preoviposition period was 6–12 days and development from egg to adult lasted 17–33 days. Of the adults, 75 per cent. were females. There are no distinct generations or periods of reproduction, and 5 generations were bred in the laboratory in 5 months. According to J. P. Fonseca and M. Autuori [*R.A.E.*, A **21** 16], females of *Stephanoderes* deposit up to 33 eggs, and the duration of development from egg to adult and the period from emergence to pairing are 34–61 and 4 days, respectively.

P. nasuta is therefore in theory more prolific than its host, but the number of eggs laid by it in nature is limited by the fact that a female entering a berry to oviposit [**22** 186] remains in that berry, so that only the larvae and pupae in it are parasitised. Observations on several hundred coffee berries showed that the numbers of parasite cocoons per berry ranged from 3 to 42, but was usually 8–20. Conditions seldom permitted the deposition of as many as 40 eggs in a single berry.

Mendes (L. O. T.). **A " broca do café " não ocorre em Haiti.** [The Coffee Berry Borer does not occur in Haiti.]—*Rev. Inst. Café Estado S. Paulo* **25** no. 148 pp. 549–551. [S. Paulo] 1939.

Mendes (L. O. T.). **Tambem na Guiana Holandesa não ocorre a " broca do café."** [Also in Dutch Guiana the Coffee Berry Borer does not occur.]—*T.c.* no. 149, pp. 664–665.

In the first of these notes, the author quotes a letter from André Audant, chief of the entomological section of the Service National de la Production Agricole at Port-au-Prince, dated March 1939 and stating that *Stephanoderes hampei*, Ferr., does not occur in Haiti. In the second, he recalls that in 1925 Stahel corrected an earlier statement that *S. hampei* occurred in Surinam [*R.A.E.*, A **13** 345]. In a recent list of coffee pests [**24** 136], R. Roba recorded it as occurring there, erroneously quoting as his authority A. da Costa Lima [**13** 388].

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **50** pts. 8–10 pp. 434–438, 494–498, 550–553, 15 figs, 1 ref. Sydney, 1939.

The first of these parts of a series on insect pests in New South Wales [*cf. R.A.E.*, A **28** 98] includes notes on the injury caused by the gladiolus thrips, *Taeniothrips simplex*, Morison, its life-history and control [**24** 211 ; **25** 788 ; **26** 552, etc.]. *Lecanium pruinosum*,

Coq., which occurs on a number of plants and sometimes becomes a serious pest of prunes and plums, and less frequently of apricots, has one generation a year. Adults occur in late spring, and the young scales migrate to the lower surfaces of the leaves and begin to feed in late November and early December. In autumn, they move to the lower surface of the laterals of the last two seasons' growth, where they spend the winter. Tar distillates, applied during the dormant or semi-dormant periods, give good control of *L. pruinosum*, but not of the San José scale [*Aspidiotus perniciosus*, Comst.] or red mites, which may also be present. Combined sprays of semi-dormant oils and lime-sulphur, however, have been satisfactory. A spray of red oil and nicotine sulphate, applied in spring, caused pronounced leaf and fruit fall.

In the second part, P. C. Hely reports that an unidentified species of *Eriophyes*, which was associated with bunched growth and contortion of the shoots of *Citrus*, was observed in New South Wales in March 1938. Navel oranges were most severely affected on the coast, and lemons in the Murrumbidgee Irrigation Area. The characteristic signs of infestation are described. Lime-sulphur or white oil applied in April at dilutions of 1 : 40 gave fairly good control, but lime-sulphur at 1 : 15 applied in June or July was more effective, and complete control was obtained when this spray was followed by another of lime-sulphur at 1 : 50 in November. During May 1939, beans from northern New South Wales were found to be heavily infested by *Maruca testulalis*, Geyer, the larvae of which tunnel into the pods and feed on the seeds. Cypress pines (*Callitris* spp.) in the south-west of the State were seriously defoliated by larvae of the Tenthredinid, *Zenarge turneri*, Rohw. Pupation takes place in the soil.

Following extensive rains and high temperatures in the autumn, resulting in excellent growth of grass, many inland pastures were damaged by insect pests, including *Loxostege affinitalis*, Led., which produces a conspicuous webbing and was prevalent in March and April, and *Neocleptria punctifera*, Wlk., which was attacked by the predacious Carabid, *Calosoma schayeri*, Erichson, and was very numerous in one district. Damage by caterpillars to seedling crops, including wheat and oats, was considerable and was probably due to these two species or at any rate to *Neocleptria*.

In the third part, it is stated that *Psara* (*Acharana*) *licarsisalis*, Wlk., attacked pasture in the north-east of the State in the second half of March 1939. The heavy autumn rains following a hot summer, however, caused the grass to recover quickly. A more general attack occurred towards the end of April, and most of the pasture land between the Clarence and Tweed rivers was affected by mid-May. J. A. Wright found that only grasses were attacked, and a feature of the damage was the subsequent excellent growth of clovers. Well-grazed areas were most severely infested ; grass six inches long was almost undamaged. The larvae feed at night, usually constructing webbing on the surface and among the grass stalks, and spend the day in the frass and mould at the base of the plants, where they pupate. The adults also are active at night. Bran baits containing Paris green or sodium arsenite, scattered lightly over the infested areas in the evening, gave 94 and 72 per cent. mortality. *P. licarsisalis* also caused severe injury to pastures in Queensland in April and May 1939.

Brief descriptions are given of the larva, pupa and adults of *Mecyna polygonalis*, Hb., which often causes serious damage to leguminous

bushes, and sometimes attacks ornamental lupins and Virginia creeper (*Ampelopsis* sp.), in eastern New South Wales. This Pyralid apparently has two generations a year; young larvae were observed in May and December, pupae in May, October and November, and newly emerged adults in June and December. The larvae can be controlled by sprays of 2 oz. lead arsenate powder and 1 oz. calcium caseinate in 5 gals. water.

Sulphur Hexafluoride used to kill Weevils.—*Agric. Gaz. N.S.W.* **50** pt. 9 p. 498. Sydney, 1939.

The use of sulphur hexafluoride (SF_6) as a fumigant against insects, especially cereal weevils, is proposed in a Hungarian patent. For the total and reliable destruction of insects, 24 hours in an atmosphere of 1 per cent. of sulphur hexafluoride or 5 hours at 2 per cent. is required. The gas is said to have no harmful effects on man in such concentrations.

WHITTAKER (E. C.). **Protect the Woolly Aphis Parasite. Treatment of Prunings important.**—*Agric. Gaz. N.S.W.* **50** pt. 9 pp. 505–506. Sydney, 1939.

It has been observed in New South Wales of recent years that *Aphelinus mali*, Hald., has not appeared in apple orchards in sufficient numbers to control the woolly aphis [*Eriosoma lanigerum*, Hsm.] until the growing season is nearly over [*cf. R.A.E.*, A **27** 548]. The author considers that this lack of control during the spring and summer months is due to a reduction in the numbers of the spring generation of the parasite, which overwinters in the host, resulting from the practices of pruning off and destroying badly infested wood in winter and spraying with miscible oils in winter [but *cf.* **27** 549] and with lime-sulphur and nicotine in spring, when the adults of the overwintering generation are emerging. He suggests that the prunings should be stored [*cf.* **24** 120] until about blossom time or a little later and then placed under the trees at various points until the parasites have emerged. After the prunings have been collected in winter, oil may be applied against the Aphids still remaining on the trees. This treatment has given good results for some years in one locality.

ALLMAN (S. L.). **The Queensland Fruit Fly. Observations on Breeding and Development.**—*Agric. Gaz. N.S.W.* **50** pts. 9 10 pp. 499–501, 547–549, 1 fig., 1 ref. Sydney, 1939.

The main features are summarised of the technique by which *Dacus* (*Strumeta*) *ferrugineus tryoni*, Frogg., was bred in the laboratory in New South Wales in 1938–39 [*R.A.E.*, A **27** 345], and observations on its life-history are recorded. The oviposition puncture in the fruit consisted merely of an oval break in the skin and could thus be distinguished from that made by the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.], which inserts its ovipositor obliquely.

Adults emerged on 21st October 1938 from naturally infested loquats [*Eriobotrya japonica*] collected in the field during September, and four subsequent generations were bred on apple in the laboratory, the adults emerging on 5th December, 16th January, 21st February and 3rd April. Since the life-cycle was found to be shorter in other fruits,

the number of generations that occur in the field per year is not limited to five. The females that oviposit in loquats, which usually become heavily infested, are presumed to be survivors of the overwintering generation. In November 1938, certain varieties of plums and peaches and occasional *Citrus* fruits were infested, probably by larvae of the second generation. Later generations would be able to breed on a succession of fruits until the end of the season. Larvae were observed in second-crop apples in 1938 and 1939 and have been present during the winter months. Some infested *Citrus* fruits may also be found in winter and early spring. Adults continued to emerge until the end of July from about 5,000 pupae that developed from larvae in second-crop apples collected towards the end of May and that were put in soil under outdoor conditions. The egg, larval and pupal stages and the life-cycle lasted 2–3, 10–31, 9–14 and 27–45 days, respectively, in the laboratory in October and November. The life-cycle varied from 36 to 45 days on apple between October and April, and lasted 57–64 days in apples infested during May ; the preoviposition period appeared to be at least 7 days. In tomato, nectarine, pear and apple, the life-cycles of individuals of which most emerged in February lasted 15–20, 20–22, 17–34 and 27–45 days, respectively. Considerable overlapping of the later generations must occur, as the oviposition period is fairly prolonged.

A large percentage of the eggs laid in *Citrus* fruits failed to hatch owing to the action of the oil from the wounded skin, and many of the larvae died before reaching the pulp. Considerable mortality also occurred among eggs laid in persimmon and among eggs and larvae in fresh apples. Similar failure to develop was occasionally observed in tomatos, pears and peaches. Laboratory investigations showed that unfertilised females deposit eggs in fruits, but although such eggs were not viable it is considered unlikely that their deposition would explain this failure to develop in certain fruits. Although *Citrus* fruits are not infested to any great extent, they are disfigured by the oviposition punctures and often drop as a result of the development of decay organisms.

There is considerable evidence that *D. f. tryoni* has of recent years replaced *Ceratitis capitata* in New South Wales. Factors that may have contributed to the decrease in the latter species include the enforced early removal from the trees of Seville and mandarin oranges, which appear to be among its preferred host-fruits. In laboratory investigations on the interaction of the two species, apples and pears were exposed to each species separately and both together. Under cage conditions, females of *Dacus* frequently oviposited in old punctures or in those made by *Ceratitis*, but the latter rarely used old punctures [*cf.* **27** 346]. In apples, *Dacus* developed almost to the exclusion of *Ceratitis*, the adults of which were abnormally small, but gave rise to individuals of normal size. *Ceratitis* developed better than *Dacus* in pears, in which breakdown in the jars was extremely rapid. Unusually high temperatures, rising to 113·6 and 118°F. in two localities in January, resulted in about 66 and 100 per cent. mortality of larvae of *Dacus* in peaches in the field.

Attempts made near Sydney to recover the Eulophid, *Syntomosphyrum indicum*, Silv., large numbers of which had been liberated during the previous season for the control of *Dacus*, were unsuccessful. No parasites were bred from larvae collected in apples, pears or peaches, but 24 examples of *Biosteres* (*Diachasma*) *tryoni*, Cam., were bred

from 372 larvae in loquats collected on 21st October (15 of them from 92 larvae leaving the fruit four days after its collection) and 1 from a larva in an orange. Cage tests of bait sprays showed that tartar emetic and sodium fluosilicate were markedly superior to lead arsenate when the adults were provided with no other supply of food, and that when an alternative supply was available tartar emetic was much more effective than either of the others.

Dacus ferrugineus tryoni is frequently confused with *D. f. dorsalis*, Hend., which breeds profusely in berries of *Solanum auriculatum* and *S. verbascifolium*. When *Solanum* berries and a green tomato were exposed to adults of *dorsalis* in a cage, 4 adults were subsequently reared from the tomato. Infestation of tomatos in the field by *dorsalis* has not been recorded, although infestation by *tryoni* is frequent.

AHMAD (Taskhir). **The Amarantus Borer,** *Lixus truncatulus* **(F.) and its Parasites.**—*Indian J. agric. Sci.* **9** pt. 4 pp. 609–627, 2 pls. (1 col.), 15 refs. Delhi, 1939.

Descriptions are given of all stages of *Lixus truncatulus*, F., which is widely distributed in India, particularly in the south, and infests the branches and stems of several species of *Amarantus*. The identified species on which immature stages were taken in the field comprised *A. caudatus* and *A. gangeticus*, which are cultivated as vegetables, and *A. viridis* and *A. spinosus*, which grow wild. *A. spinosus* was infested only if the other species were scarce or absent. The weevil has been recorded from other plants, but did not breed in them in the laboratory. A preliminary account of its bionomics as observed in the laboratory at Pusa has already been noticed [*R.A.E.*, A **25** 530]. The life-cycle from egg to adult is completed in about two months and there are at least three generations from March to November ; they overlap owing to the irregular larval development. During the winter, all stages undergo some development during the day.

Females oviposit within a few days of emergence, and lay their eggs singly in the tender branches of the plant, or in the petioles or midribs of the leaves. The eggs are thus in contact with cell-sap; they possibly require direct contact with free water for development, as those that were removed from the plants and kept in a partly saturated atmosphere did not hatch. At room temperature in March and November, the egg stage lasted 10–12 days ; at constant temperatures of 20 and 27°C. [68 and 80·6°F.], it lasted 10 and 4 days, respectively. Larvae that hatched between 26th March and 12th April pupated after 40–65 days, whereas those that hatched at the end of October or beginning of November overwintered in the larval stage. The way in which the larva bores in the plant is described. As a result of the infestation, the plant is stunted, the older branches and the main stem become twisted and swollen, and few new shoots, leaves or flowers are produced. The larvae can withstand starvation for considerable periods, particularly during cold weather. The pupal stage, which is passed in a wide chamber in the stem of the infested plant, lasted 9–10 days at 27°C. and at room temperature in April, and 20–24 days at 20°C. The adults survived for 4–6 months. Freshly emerged weevils starved at a constant temperature of 27°C. lived for an average of 9·2 and 7·6 days at saturation deficiencies of 9 and 0 mm., respectively, which indicates that a saturated atmosphere (which is essential for the eggs and larvae) is detrimental to the adults.

Parasites bred from *L. truncatulus* comprised the Eulophid, *Pareuderus torymoides*, Ferrière, and two Eupelmids of the genus *Anastatus* from the eggs; the Pteromalid, *Dinarmus sauteri*, Masi, from the larvae; and *Eurytoma curculionum*, Mayr, from the larvae and pupae. None of these parasites has previously been recorded from this host or from the Indian region; descriptions are given of various stages of each of them, including the hitherto undescribed male of *D. sauteri*. *P. torymoides* was the most important, and parasitised up to 31 per cent. of the eggs in Pusa in the winter of 1936–37. The egg, larval and pupal stages lasted 1, 6 and 5–6 days at 27°C. and 2, 10 and 8 days at 17–21°C. [62·6–69·8°F.]. A single egg is deposited just above the egg of the host in the cavity in which it was laid; the larva feeds on the contents of the host egg and pupates beside it. The bionomics of the two species of *Anastatus* are similar, but the rate of parasitism by them was much lower. At 27°C. the egg, larval and pupal stages lasted 2, 5–7 and 6–7 days. A number of adults of *Telenomus javensis*, Dodd, emerged in cages containing twigs of *A. caudatus* infested by different stages of *L. truncatulus*, and it is believed that this Scelionid parasitised the eggs of the weevil. In four instances Cecidomyiid larvae were found in association with eggs of *Lixus*, and are considered to have been predacious on them; none of the eggs hatched. Two of the larvae gave rise to adults identified as *Lestodiplosis* sp. The larva, pupa and adult are briefly described.

Pruthi (H. S.) & Nigam (L. N.). **The Bionomics, Life-history and Control of the Grasshopper** *Poecilocerus pictus* **(Fab.).—A new Pest of cultivated Crops in North India.**—*Indian J. agric. Sci.* **9** pt. 4 pp. 629–641, 2 pls. (1 col.), 2 refs. Delhi, 1939.

The grasshopper, *Poekilocerus* (*Poecilocerus*) *pictus*, F., feeds chiefly on a wild species of *Calotropis*, but in 1937 it caused considerable damage at Shadipur, near Delhi, to brinjal [*Solanum melongena*], castor and tomato, to which the hoppers migrated when the supply of *Calotropis* became exhausted. In experiments, it fed readily on a number of cultivated plants and must be regarded as a potential pest. The life-cycle and all the immature stages are described. The eggs are laid in the soil in June–August, and hatch in March–April. The hoppers reach the adult stage about the end of May, after 5 or 6 moults, and oviposition begins 20–26 days after the final moult. Control experiments suggest that spraying with sodium arsenite (8 oz. per 100 gals. water) is most satisfactory. At this concentration, the arsenite did not scorch the plants. A bait containing sodium fluosilicate was refused by hoppers in cages, and it cannot be successful in the field, since the hoppers seldom leave the plants and have no chance of finding bait on the ground.

Garthwaite (P. F.). **Biology of** *Calopepla leayana* **Latr. (Chrysomelidae, Col.) and the Possibilities of Control.**—*Indian For. Rec.* (N.S. Ent.) **5** no. 2 pp. i–iv, 237–277, 2 pls., 10 refs. Delhi, 1939. Price 2*s.* 6*d.*

Two extensive plantations of *Gmelina arborea* established in the Northern Shan States, Burma, in 1924 and 1928 were abandoned in 1934 and 1936, respectively, chiefly owing to severe defoliation by the

larvae and adults of *Calopepla leayana*, Latr. During the infestation, which was first observed in 1928, investigations on the bionomics and control of this Cassidid were made, and a detailed account is given of the results, some of which have already been noticed [*R.A.E.*, A **21** 184 ; **22** 123 ; **23** 210 ; **24** 241 ; **25** 455]. Descriptions of all stages of the beetle are included, with notes on its synonymy and distribution, and on the history of the plantations and the prevailing climatic conditions.

C. leayana occurs in moist deciduous forests where *Gmelina* is common, but is of economic importance only in pure stands. The egg stage lasts 6–11 days, with an average of 7, between May and October. The larvae feed for 17–19 days and for a few days longer under crowded conditions or at the end of the season, when the weather is colder. Larvae in the first three instars feed chiefly on the parenchyma of the leaves, while those in the fourth and fifth instars skeletonise them. Pupation occurs, after a pre-pupal period lasting 1–3 days, on the base of leaves or on the petioles, and the pupal stage lasts 6–8 days. The adults are active by day ; during heavy rain, which kills many young larvae, they shelter under leaves and in the undergrowth. They not only skeletonise the leaves, but also injure the young growing shoots. When disturbed, they drop to the ground ; their powers of flight are strong, however, since during hibernation flights they have been observed on the wing a mile from the plantations. Males and females were observed in approximately equal numbers, and pairing and oviposition did not occur until some time after emergence. During oviposition, a single layer of eggs is deposited on the leaf stalks or on the lower surface of leaves in an ootheca, composed of a sticky, frothy secretion that hardens on drying and may contain as many as 100 eggs, although the usual number is 60 ; smaller groups are deposited at the beginning and end of the oviposition period, which lasts 40 days or longer. The usual number of egg-masses per female is 15. The average longevity of adults of the first generation, which emerge in June, is 53 days, with a maximum of 120 ; the overwintering adults, which leave the plantations for hibernation in August–October live for at least 7 months.

Tables show the duration of each of the immature stages in central Burma and at Dehra Dun, in northern India, where they were somewhat shorter, the dates on which oviposition, hatching, pupation and emergence began in outdoor cages in Burma in each year in 1930–35, and the latest and earliest dates on which hibernation began and ended, respectively. No third generation occurred in Burma during 1932 35. After feeding for as long as one month, adults of the second or third generations hibernate, often gregariously, under bark high up in dead standing trees, in crevices in such trees and in felled trees in the open, in bamboo stumps and fencing, in thick *Imperata* grass in or near plantations, in thatch and in fallen leaves. The overwintered adults return to the plantations when the monsoons break in April or May.

The most important parasites of *C. leayana* in Burma were an undescribed Chalcid of the genus *Brachymeria* and a Eulophid of the genus *Tetrastichus*, and the distribution and bionomics of these are described in detail. Eggs of *Brachymeria* are deposited, normally at the rate of 1 per host [**21** 184], in pre-pupae and pupae. During the summer, mated females lived for about 50 days, ovipositing daily, and overwintering adults survived from 5th November until

10th April. Of a total of 1,000 individuals, 75 per cent. were females. The life-cycle lasted 18–20 days during June–September and was very much longer after October, when hosts are not available in nature ; in northern India, it lasted 14 days. The parasite is believed to pass through 5–6 generations during the time occupied by 2 generations of the host. The adults overwinter under dead leaves or in thick grass, old trees, etc., but in the insectary survival never exceeded 10 per cent. Parasites that emerged after September survived without hosts and were used for rearing new supplies when hosts became available the following year. Since activity begins in April, a complete generation could be reared a month before the host appears. The percentage parasitism was estimated to be 30–37 during August ; in northern India during 1932, it was low at the beginning of August, reached a maximum of 50 early in September and then decreased to 21 at the beginning of October, probably owing to hyperparasites, which became evident at the end of August. Two Chalcidoid hyperparasites were observed in Burma. The pre-adult period of *Brachymeria* was extended to 41 days when the host pupae were placed in cold storage 12 days after being parasitised and were left there for 24 days, but more parasites survived when it was extended to 31–36 days by placing the host pupae in cold storage 1–10 days after parasitism and leaving them there for 18–24 days. Attempts to use the Cassidids, *Aspidomorpha miliaris*, F. [*cf.* **24** 242], *A. dorsata*, F., and *Epistictia viridimaculata*, Boh., as hosts were unsuccessful, and the number of parasites that emerged when *Laccoptera quadrimaculata*, Thnb., was used was too small.

Tetrastichus sp. successfully parasitised eggs of *C. leayana* not more than 6 days old. The egg, larval and pupal stages and the pre-oviposition period lasted 1, 6, 5 and 2–3 days, respectively, and 9 generations occurred between 13th June and 17th October. The longevity of adults of both sexes is normally about 40 days, but overwintering adults lived as long as 197 days during October–April. Males and females occurred in the ratio of 1 : 3. Hibernation lasts from October to May, but the percentage that survived the winter in the laboratory was low. Attempts to rear the parasite on egg-masses of *A. miliaris*, *A. dorsata* and *L. quadrimaculata* were unsuccessful.

Other parasites of *C. leayana* include two Eulophids of the genus *Tetracampe*, both of which attack the eggs ; *Sarcophaga crinita*, Parker, which attacks the pupae ; and the Calliphorid, *Chaetoptiliopsis burmanica*, Baranov, pupae of which were observed in overwintering adults that were believed to have been parasitised during hibernation. Other natural enemies include the Pentatomid, *Cantheconidea* (*Canthecona*) *furcellata*, Wolff, Nematodes and a bird (*Dendrocitta formosae*).

The control measures that were carried out in the plantations are discussed and further recommendations are made ; since no effective imported parasite has become established [*cf.* **23** 211], economic control can be obtained only by a combination of methods. The trees should be planted only on optimum sites and the plantations should be divided into blocks separated by natural forest. Hand-collection is considered to be justified when combined with other measures and restricted to overwintered adults newly returned to the plantations, against which applications of insecticides are also of value. The destruction of hibernation quarters is often impracticable, but, besides its direct value, it may be used to induce the adults to enter traps of thatch that simulate hibernation quarters. Such traps, which are

described, should be exposed in August or September at some height from the ground, and should be examined and the adults destroyed during March and early April. The adults can also be trapped by means of white sheets [**24** 241], or by large funnels painted white inside, from which they fall into containers filled with kerosene. Mass rearing and liberation of indigenous parasites early in the season is probably of value in reducing injury during the current year.

VIADO (G. B.). **External Anatomy and diagnostic Characters of some common Philippine White Grubs.**—*Philipp. Agric.* **28** no. 5 pp. 339–390, 10 pls., 13 refs. Los Baños, 1939.

Records of injury to sugar-cane and other crops in the Philippines by Lamellicorn larvae are briefly reviewed, and an account is given of the comparative morphology of the larvae of *Leucopholis irrorata*, Chevr., and *Lepidiota blanchardi*, Dalla Torre, which are the most injurious species, followed by descriptions of the diagnostic characters of the larvae of six other species, most of which were reared from adults taken on plants or at light at Los Baños. A key to the larvae of the eight species is given, and the measurements of various parts of their bodies are shown in detail in tables.

GHESQUIÈRE (J.). **Rapport préliminaire sur l'état sanitaire de quelques palmeraies de la province de Coquilhatville.**—*Publ. Inst. Étude agron. Congo belge* Sér. sci. no. 3, 40 pp., 33 refs. Brussels, 1935. Price *Fr.* 4. [Recd. 1939.]

This paper on diseases and pests of the oil palm (*Elaeis*) in the Belgian Congo includes an annotated list (pp. 32–36) of some of the insect pests found during the investigation. A fuller account of the author's observations on this subject is to be published. The species of economic importance include the Dynastids, *Oryctes owariensis*, P. de B., *O. monoceros*, Ol., and *Dynastes* (*Archon*) *centaurus*, F., the Cetoniid, *Platygenia barbata*, Afzel., the weevil, *Temnoschoita quadripustulata*, F., the Pyralid, *Pimelephila ghesquierei*, Tams, which is the most injurious pest in young plantations [*cf. R.A.E.*, A **27** 348], the Stratiomyiid, *Hermetia pennicornis*, Bezzi, the larvae of which infest the flowers and sometimes bore from them into the central shoot, and the Coccids, *Aspidiotus destructor*, Sign., *A. lataniae*, Sign., and *Pseudococcus brevipes*, Ckll.

MARTELLI (G. M.). **Agrumi, cocciniglie e fumigazioni cianidriche nella Libia Occidentale.** [Citrus Trees, Coccids and Fumigation with Hydrocyanic Acid Gas in West Libya.]—*Agric. colon.* **33** no. 12 pp. 678–685, 2 figs., 8 refs. Florence, 1939.

In Libya, the cultivation of *Citrus* is limited to the province of Tripoli. Conditions in the plantations and cultural practices are described. In most plantations, lack of pruning reduces the effectiveness of sprays applied against Coccids, and in mixed plantations, dense growth and the shade of palms and other tall trees provide optimum conditions for them. Young, unmixed plantations, in which windbreaks are usually undeveloped, are generally the least infested, owing to the considerable mortality of Coccids that is caused in them by the dry hot winds that blow from the desert. Prior to 1938,

Chrysomphalus dictyospermi, Morg., the most widespread species, was controlled by mineral-oil emulsions, applied once a year and not always every year, but in view of the disastrous spread of infestation, this is no longer possible, except in rare instances. Other Coccids on *Citrus* in Libya are, in order of decreasing importance, *Parlatoria pergandei*, Comst., *Aspidiotus hederae*, Vall., *Lepidosaphes beckii*, Newm. (*citricola*, Pack.), *Icerya purchasi*, Mask. (which appears sporadically and is at once destroyed by *Rodolia cardinalis*, Muls.), *Saissetia oleae*, Bern., and *Pseudococcus citri*, Risso. *P. pergandei* is commonest in mixed plantations and in those near oases, *S. oleae* is widespread, but is nowhere numerous owing to natural enemies, while the others occur locally. The author concludes by suggesting that fumigation with hydrocyanic acid gas would be possible in many cases, although climatic conditions are unfavourable and many practical difficulties would have to be overcome.

VERHOEVEN (W. B. L.). **Overzicht van de belangrijkste ziekten en plagen van landbouwgewassen en hun bestrijding.** [A Survey of the most important Diseases and Pests of agricultural Plants and of their Control.]—*Versl. PlZiektenk. Dienst Wageningen* no. 92, 174 pp., 16 pls. Wageningen, 1939.

A list is given of the more important diseases and pests of the principal agricultural field crops in Holland. They are arranged under the crops attacked and mostly under their popular names in Dutch, and very brief notes on control are given for each. The subject of control is dealt with more fully in sections at the end, which also include general information on the commoner insecticides and fungicides. Each alternate page is left blank for the insertion of notes.

Germany : First Records of the Colorado Beetle in 1939.—*Int. Rev. Agric.* **30** no. 11 p. 253M. Rome, 1939.

Leptinotarsa decemlineata, Say, was reported in various districts of western Germany in 1939 in April [*cf. R.A.E.*, A **27** 512] and early May. The females began ovipositing on potato towards the end of May and the beginning of June, and the earliest larvae were observed during the first week in June and the first pupae on 25th June. By mid-August, the beetle was reported from 2,250 communes, most of which were within the zone invaded in 1938 though some of those infested in 1938 were free from attack. Infestation spread to further communes in Baden, Bavaria, Prussia and Würtemberg.

MAYNÉ (R.). **L'expérience acquise par quatre années d'invasion doryphorique.**—*Verh. 7. int. Kongr. Ent., Berlin 1938* **4** pp. 2690–2694, 1 ref. Weimar, 1939.

A brief review is given of the measures that were used to eradicate *Leptinotarsa decemlineata*, Say, on potato in Belgium in 1935, when 30 foci were discovered in 22 communes [*R.A.E.*, A **23** 739, 740; **24** 86], and in 1936 and 1937. They were essentially the same as those already noticed [**27** 583], and their effectiveness was demonstrated by the fact that although the beetle appeared in 1936 and 1937 in 116 and 39 foci in 45 and 17 communes, respectively, all but two of these foci were new and infestation did not recur in localities in which it had been discovered and treated in the preceding year. The author

distinguishes three stages in the invasion of a country by the beetle and discusses them at some length. It is emphasised that it is possible by co-operative action to prevent any infestation from progressing beyond the initial stage.

The Importation of Plants (Amendment) Order of 1940.—*S. R. O.* 1940 no. 544, 2 pp. London, 10th April 1940.

This Order, which came into force on 21st April 1940, imposes on the landing in England or Wales of plants, potatoes, raw vegetables and cider apples grown in Spain [in which country *Leptinotarsa decemlineata*, Say, has been found] restrictions similar to those applied to them when grown in Switzerland [*R.A.E.*, A **27** 356]. Raw vegetables imported from Belgium, Germany, Luxemburg or the Netherlands between 21st April and 31st May in any year must be accompanied by a certificate of origin [*cf. loc. cit.*].

James (H. C.). **Further Studies on the reproductive Methods of certain Species of Coccidae (Homoptera).**—*Trans. R. ent. Soc.* **89** pt. 12 pp. 569–577, 1 fig., 8 refs. London, 1939.

The following is substantially the author's summary of studies based on material obtained in the Cambridge Botanic Gardens: In controlled experiments with *Orthezia insignis*, Dgl., on a species of *Coleus*, families consisting of females only were obtained. The male of the species was never found. Dissections and histological examination of the ovaries failed to disclose any indication of hermaphroditism, and it is certain that the unisexuality of the progeny is the result of diploid parthenogenesis. The fecundity of *O. insignis* is much higher than previously published accounts indicated. The largest family obtained from among 70 females was 404 females, with an average family per female of 218·86. The mode of oviposition in this species enabled the length of the egg-laying period to be measured with great precision. It varied from 38 to 120 days for 70 females with an average per female of 65·57 days.

Pseudococcus nipae, Mask., was found to be oviparous, and reproduction is entirely zygogenetic. In the families of 66 females reared on a date palm (*Phoenix silvestris*) the numbers of males per 100 females varied from 10 to 287·5, but the zone in which the family ratios of this species usually fall is between 20 and 50 males per 100 females. The specific sex ratio was $43{\cdot}70 \pm 4{\cdot}37$ males per 100 females. The fecundity of the species is low for the Pseudococcinae and averaged 76·08 per female. The markedly unbalanced nature of the specific sex ratio of *P. nipae* provides further evidence [*cf. R.A.E.*, A **26** 105] that the male-producing sperm in *Pseudococcus*, though produced in numbers equal to those of the females, is functionally much less efficient. Evidence is also adduced that the evolution of haploid males is taking place in *Pseudococcus*.

Controlled experiments with females of *Saissetia nigra*, Nietn., on *Phoenix silvestris* resulted in progeny of only one sex, 37 females producing 13,688 females. In addition, close observation of the species on its common food-plants failed to disclose a male. In view of the description of the male from other parts of the world, it is probable that the material studied represents an obligatorily parthenogenetic race of the species.

DICKER (G. H. L.). **Insects associated with cultivated Forms of *Rubus*.**—*Trans. Soc. Brit. Ent.* **6** pt. 5 pp. 115–136, 15 refs. Southampton, 1939.

Brief notes are given on the bionomics of 132 species of insects and 9 mites observed in England to breed on or to be associated with blackberry, raspberry and other cultivated forms of *Rubus*.

DICKER (G. H. L.). **The Morphology and Biology of the Bramble Shoot-webber, *Notocelia uddmanniana* L. (Tortricidae).**—*Ann. appl. Biol.* **26** no. 4 pp. 710–738, 1 pl., 10 figs., 14 refs. London, 1939.

This paper contains full descriptions of the morphology of all stages of *Eucosma* (*Notocelia*) *uddmanniana*, L., which is of local importance as a pest of loganberries in south-eastern England, together with details of field and laboratory investigations on the bionomics of this Tortricid, an account of which has already been noticed [*R.A.E.*, A **28** 101]. In 1937, when the summer was favourable for development, 10 fully grown larvae were collected during the second week of August. They pupated almost immediately in the laboratory, and two females and one male emerged on 24th August, and one male on 31st August. Mating took place and many eggs were laid. The resulting larvae had all entered hibernation by the end of September, when most were in the second instar. A few continued their development in 1938, although more slowly than individuals from adults present in the previous June. There was no evidence of a partial second generation in the field.

Records of the numbers of adults captured in light traps at Rothamsted during 1933–35 were communicated by C. B. Williams and indicate that a few adults are active throughout the night, but most are present during the period immediately before midnight.

BARNES (H. F.). **The Chrysanthemum Midge.**—*J. R. hort. Soc.* **64** pt. 11 pp. 503–506, 1 pl. London, 1939.

An account is given of the results of work in England on the Cecidomyiid that attacks commercial chrysanthemums and has erroneously been considered to be *Misospatha* (*Diarthronomyia*) *hypogaea*, F. Lw. [it has recently been described by Ahlberg as *D. chrysanthemi* (*R.A.E.*, A **28** 111)]. The investigations were concerned with the range of food-plants of the midge [**27** 673] and with its bionomics and control [*cf.* **25** 389].

Adults emerge throughout the year, but pairing and oviposition occur only at temperatures above freezing point. There are five overlapping generations a year in unheated glasshouses and eight under warmer conditions. The adults of each of them emerge over a long period. The duration of the life-cycle from egg to adult was shortest (26 days) from late July to August and longest (149 days) during the winter. In the United States, this Cecidomyiid has eight generations a year, of which three in the spring and three in the autumn develop quickly, while the summer generation aestivates and develops very slowly, and the winter generation hibernates.

The midges emerge early in the morning and, if the weather is bright and warm, usually die on the same day. Under such conditions,

oviposition is mostly completed by noon, whereas on dull cold days, or in winter, it continues all day and sometimes even into the third day. The eggs are deposited among the buds, in the folds of young leaves, on the sepals of the flower buds, and occasionally on the green stems. The egg stage lasts 3–4 days in summer and up to 14 in winter. The larvae enter the plant tissue within 24 hours of hatching. In summer, the resulting galls become visible 16 days after oviposition, but in winter attack does not become evident for about 100 days. The galls occur on both surfaces of the leaves, the stems and the sepals. The pupal stage lasts 6–7 days in the warmest weather and up to 6 weeks in winter. Adults can emerge up to the end of February from galls formed in late autumn on leaves and stems that subsequently die and become brittle, and the Cecidomyiid can overwinter in the open as a young larva and in the galls. Parasites and predators are of little importance in its control. *Eutelus diffinis*, Wlk., the larvae of which are endoparasitic in those of the midge, has been reared from galls, the common earwig [*Forficula auricularia*, L.] feeds on the galls and the larvae and pupae in them, and two bugs and a mite destroy the eggs and the adults while they are ovipositing or emerging.

Fumigation and spraying with nicotine are of value for preventing an increase of infestation, but would have to be carried out every night for several weeks to eradicate it [*cf.* **25** 389]. Most of the eggs and some of the very young larvae can be killed by dipping the cuttings in nicotine (95–98 per cent., 1 : 800) and soap (1 oz. to 1 gal.) for five seconds. The most effective measure, however, is to cut off and burn all growth of infested plants above ground level and burn all plant refuse. If necessary to maintain the stock, the stools should then be isolated and cuttings taken from the new growth. Eradication of the insect should be possible if all growers practise this method each winter in co-operation.

WRIGHT (D. W.). **The Control of Lettuce Aphis.**—*Fruit-Grower* **88** no. 2291 pp. 539–540, 2 figs. London, 1939.

The leaves of both cos and cabbage lettuces are often severely curled and blistered by Aphids, and these insects are also responsible for the spread of lettuce mosaic. Observations carried out over three years in eastern England, where the most abundant species is *Macrosiphum ribicola*, Kalt. (*Myzus lactucae*, Schr.), have shown that the Aphids overwinter freely in lettuces of the winter crop, which become infested in the seed bed in September and October. They breed slowly during winter, but increase more rapidly in late March and April. Winged individuals produced throughout May migrate to other plants of the same crop, much of which becomes unfit for sale, and to spring lettuce. Early summer lettuce may be severely attacked, but later in the season there is usually a considerable decline in the Aphid population.

Recent experiments on control have shown that the damage caused in spring to the winter crop can be prevented by submerging the plants for three minutes at the time of transplanting in a wash consisting of 1 oz. nicotine (95–98 per cent.), 1 oz. sulphonated lorol and 9 gals. water. This is sufficient to dip about 1,000 plants at a time and can be used six times. In eastern England, transplanting is usually best carried out during the last week of October and first two weeks of November. If it takes place too early, reinfestation is likely to occur,

but it must not be delayed until the weather is severe. All old lettuce near a proposed seed bed should be ploughed under or otherwise destroyed before the seed is sown. Control on the summer crop is more difficult, as reinfestation by winged migrants continues throughout the summer. Crops showing signs of attack should be treated with a 3 or 4 per cent. nicotine dust or sprayed with the nicotine preparation recommended for dipping the winter crop. Nicotine dust should not be used on crops about to be cut.

STOREY (H. H.). **Transmission of Plant Viruses by Insects.**—*Bot. Rev.* **5** no. 4 pp. 240–272, 90 refs. Lancaster, Pa., 1939.

Although it is known that the great majority of plant viruses depend on leaf-sucking insects for their transmission, many points in connection with the process of transmission are still obscure. The author therefore reviews data from the literature on the ways in which the insect vector obtains the virus, carries it, and transmits it to a healthy plant.

STOREY (H. H.). **Investigations of the Mechanism of the Transmission of Plant Viruses by Insect Vectors. III. The Insect's Saliva.**—*Proc. roy. Soc.* (B) **127** no. 849 pp. 526–543, 1 pl., 2 figs , 19 refs. London, 1939.

The following is based on the author's introduction and summary of this third paper of a series [*R.A.E.*, A **22** 11 ; **26** 756] : For the type of virus transmission characteristic of leafhopper vectors, there is convincing evidence that the virus passes through the insect's body. The manner in which it emerges from the insect and is inoculated into a plant is much less certainly known. It has generally been assumed that the saliva is the vehicle of the inoculation, but there is even now little direct evidence for this assumption. Observations were therefore carried out on the excretion of saliva by *Cicadulina mbila*, Naudé, and attempts were made to demonstrate experimentally in this saliva the virus of streak disease of maize, of which this Jassid is a specific vector. It was found that when puncturing through a membrane into a fluid, *C. mbila* ejects saliva only when its stylets are in motion, and not when they are at rest and fluid is being drawn into them. This saliva sets to a gel and is moulded internally by the stylets to form a sheath. No other material of insect origin has been observed to flow from the stylets. The salivary glands of infective insects, when inoculated into the abdomens of non-infective ones, caused a few of these to become infective. Comparative experiments with other organs from the insect support the interpretation that the salivary glands may contain virus, either in small quantities or occasionally.

Attempts to demonstrate virus in a fluid upon which many infective insects had fed were almost always negative. Only when infective and non-infective insects fed simultaneously on a film of fluid held between two membranes did a few of the non-infective insects become infective, and these never caused infection more than once in a series of tests. Results were similar with a maize leaf on which infective insects had fed. Simultaneous feeding on a small area of leaf alone caused a few non-infective insects to become infective, and these again were of low infective ability. It is suggested that an infective leafhopper ejects virus in very small quantities, so that only rarely can another individual

take up enough ejected virus to make it infective, and then it is only weakly so. The manner in which the virus is carried into the plant is still obscure; it is difficult to reconcile the view that the gelling saliva is the vehicle with the evidence of an earlier paper [**26** 756].

WATSON (M. A.) & ROBERTS (F. M.). **A comparative Study of the Transmission of *Hyoscyamus* Virus 3, Potato Virus Y and Cucumber Virus 1 by the Vectors *Myzus persicae* (Sulz.), *M. circumflexus* (Buckton), and *Macrosiphum gei* (Koch).**—*Proc. roy. Soc.* (B) **127** no. 849 pp. 543–576, 1 pl., 36 refs. London, 1939.

The following is largely the authors' summary: Three strains of *Hyoscyamus* virus 3, two of cucumber virus 1, and potato virus Y were tested for their transmissibility by the Aphids, *Myzus persicae*, Sulz., *M. circumflexus*, Buckt., and *Macrosiphum solanifolii*, Ashm. (*gei*, auct.). The efficiency of each Aphid in transmitting each virus increased with increasing time of fasting before feeding on the infected plants [*cf. R.A.E.*, A **26** 615]. Their efficiency decreased as the time of feeding on the infected plants increased [*cf.* **26** 342]. The most probable explanation of these effects is that the viruses are inactivated by some substance produced by the Aphids when feeding. The most successful vector on the whole was *Myzus persicae*, and the least successful was *Macrosiphum solanifolii*, but the relative efficiency of the vectors varied with the different viruses, indicating that their degree of success depended upon several interacting factors. The most important of these factors appeared to be the concentration and localisation of virus in the plant, and the capacity of the vector for inactivating the virus. The viruses that have thus been shown to be similar in their insect-virus relationships are also similar in their physical properties, and there are many other viruses transmitted by Aphids that resemble them in this respect. It is suggested that such viruses may form a natural group, with the same type of vector-virus relationship. This relationship appears to be a complex one, and it is unlikely that the viruses are mechanically transmitted.

CORBETT (G. H.) & MILLER (N. C. E.). **The Identification of Grubs from Rubber Estates.**—*Sci. Ser. Dep. Agric. S.S. & F.M.S.* no. 22, 7 pp., 4 pls., 1 fig. Kuala Lumpur, 1939. Price *Cts.* 50.

Descriptions and figures are given of the distinguishing characters of the larvae of a Lucanid, 8 Melolonthids and 8 Rutelids received from rubber estates in Malaya, together with photographs of the adults. It is probable that the Lucanid larvae were obtained from a decaying log and not from the soil. Brief general notes on the diet of the larvae of the other two families and their behaviour on the surface of the soil and general appearance are included, and the Malayan distribution of the species found is given. The economic importance of most of these grubs in relation to rubber has not been established. The principal damage caused is to the roots of indigenous covers and to the soil by tunnelling, which promotes erosion. The Melolonthid, *Psilopholis vestita*, Sharp [erroneously recorded from Malaya as *P. grandis*, Lap. (*R.A.E.*, A **20** 398 etc., 600; **25** 64, 97)] has, however, been of importance as a pest of rubber, of which it attacks the roots. It was first reported in 1930 on a comparatively clear area of rubber bordered on three sides by jungle. Land planted with rubber and

adjoining extensive areas of jungle appears from the records to be its principal habitat. It is considered that, while clean cultivation was practised, the larvae may have been present on rubber estates, but confined to the neighbourhood of the jungle, and that the introduction of indigenous and other covers created conditions so resembling those of the jungle fringe that the beetles no longer had to return to their original habitat to find suitable conditions for feeding or oviposition.

Ba Te (A.). **Cotton-pests in Burma.**—*Bull. Dep. Agric. Burma* no. 8 (1st revd edn) 35 pp., 10 pls. Rangoon, 1939. Price 9*d*.

This bulletin, which is a revision of a previous edition (1912), contains a list of 22 insects, groups of insects, and mites that attack cotton in Burma, with notes on their bionomics and suggestions for the control of some of them. None of them is of major importance, at any rate on native varieties of cotton, which are very hardy, probably because their numbers are reduced by the hot weather during March–April. Consequently, no control measures have been attempted against them except for the encouragement of good cultivation, crop rotation, and the early removal of standing cotton after harvest, and the discouragement of ratooning and continuous cropping. Foreign cotton, which is grown to a small extent, sustains serious damage from attack by insects, principally *Dysdercus cingulatus*, F., and *Sylepta derogata*, F., but this is lessened by delaying sowing until August. Attempts have been made to raise improved varieties by crossing the foreign varieties with indigenous or Indian ones. Regulations are in force to prevent the introduction of foreign pests.

The most abundant pests include *Brachytrypes portentosus*, Licht., an undescribed Tenebrionid and larvae of *Lachnosterna* (*Holotrichia*) sp., which attack the seedlings ; *Pempheres affinis*, Fst., which bores the stem just below ground level ; *Aphis gossypii*, Glov., a species of *Eriophyes* and *S. derogata*, which attack the leaves ; and *Platyedra gossypiella*, Saund., and *D. cingulatus*, which feed on the bolls.

Murayama (J.). **Notes sur les scolytides du Manchoukuo.**—*Annot. zool. jap.* **18** no. 2 pp. 137–144. Tokyo, 1939.

Records are given of 15 species of Scolytids taken in Manchuria on various forest trees, 11 being from pine. They include a new species, *Cryphalus jeholensis*, which is described from *Pinus tabulaeformis*. Those mentioned individually as causing considerable injury are *Scolytus ratzeburgi*, Janson, on *Betula japonica mandshurica*, *Ips* (*Pityogenes*) *bistridentatus*, Eichh., on *P. tabulaeformis*, and *I. acuminatus*, Gylh., on *P. tabulaeformis*, *P. koraiensis* and *Picea jezoensis*.

Watanabe (C.). **A new Species of** *Apanteles* **bred from** *Daimio tethys* **Ménétriès, with Notes on other Species.**—*Insecta Matsum.* **13** no. 4 pp. 129–131, 2 refs. Sapporo, 1939.

Descriptions are given of both sexes of *Apanteles ishizawai*, sp. n., which parasitises the larvae of the Hesperiid, *Daimio tethys*, Mén., near Tokyo, together with notes on the characters of *A. plutellae*, Kurdj., reared from larvae of *Plutella maculipennis*, Curt., in Sakhalin,

and *A. kariyai*, Watan., which was originally described from *Cirphis unipuncta*, Haw., in Manchuria [*R.A.E.*, A **26** 296] and has since been obtained from an unspecified host in Honshu.

JEPSON (W. F.). **Progress in Parasite Importation during 1938.**— *Rev. agric. Maurice* no. 105 pp. 82–84. Port Louis, 1939.

A brief account is given of surveys carried out in a number of countries to discover natural enemies suitable for introduction into Mauritius for the control of various pests and of work on the rearing and liberation of parasites and predators in the Island during 1938.

Consignments of six common parasites of Dynastids and Melolonthids observed in Natal during a survey in 1937 were shipped to Mauritius at the beginning of 1938 for the control of *Lachnosterna* (*Phytalus*) *smithi*, Arr. No adults of the Tachinid, *Microphthalma europaea*, Egger, which has a wide distribution and host range, developed from the parasitised larvae of a Dynastid, *Heteronychus* sp., that were sent to Mauritius from Natal, and its importation was discontinued. Parasitism by the Ortalid, *Adapsilia latipennis*, Wlk., of adults of the Melolonthid, *Hypopholis sommeri*, Burm., in Natal was in some districts as high as 50 per cent., but only a few adults emerged at long intervals from many thousands of puparia shipped to Mauritius under various storage conditions. *Pexopsis pyrrhaspis*, Villen. [*R.A.E.*, A **27** 611] was less abundant than *Adapsilia*, but became more plentiful during March–April, when adults of *H. sommeri* were becoming scarce. This Tachinid was easily transported in the pupal stage, which lasts 15 days, and pairing took place readily in captivity. Observations showed that *P. pyrrhaspis* is able to complete its development in adults of *Lachnosterna*, and over 2,000 adults were released in the field. Nearly 3,000 females of the Scoliids, *Campsomeris felina*, Sauss., *C. aureoloides*, Bradley, and *C. madonensis*, du Buy., which parasitise larvae of *Heteronychus* and a Melolonthid (*Schizonycha*) in Natal, were liberated and are expected to colonise the drier areas in the northern part of the Island, since the annual rainfall in their natural habitat does not exceed 45 ins.

During 1938, collections of parasites for the control of *Lachnosterna* were made in Algeria and Morocco, as a result of which consignments of *Dexiomorpha picta*, Mg., which parasitises larvae of the Melolonthid, *Rhizotrogus carduorum*, Erichson, were sent to Mauritius, where 250 adults were liberated. The prospects of establishment of this Tachinid are considered to be good, since it has a wide host range in Europe and the larvae of *Lachnosterna* and *Rhizotrogus* are almost identical in size and structure. Small numbers of *M. europaea* and *P. pyrrhaspis* occur in Zanzibar, where they parasitise the larvae and adults, respectively, of the Melolonthid, *Entyposis impressa*, Kolbe, and in view of the short journey involved, importations from this island are to be attempted.

The importation, rearing and liberation of the Javan Coccinellid [*Chilocorus politus*, Muls.] introduced for the control of *Aspidiotus destructor*, Sign. [**26** 204 ; **27** 611] were continued ; this predator is now established and is exerting control in two districts. In December 1938, a consignment of Chalcidoid parasites of *A. destructor*, consisting chiefly of the Encyrtids, *Spaniopterus crucifer*, Gah., and *Chiloneurinus microphagus*, Mayr, was received from Java, and a few individuals were liberated. The predacious Coccinellid, *Rodolia* (*Vedalia*) *cardinalis*,

Muls., which was imported from South Africa [**27** 611], was reared successfully on *Icerya seychellarum*, Westw., and over 1,000 adults were released. The work was greatly hindered by the seasonal decline in abundance of the Coccid, but further supplies of *R. cardinalis* are to be imported. A small consignment of the Coccinellid was sent to the Seychelles in December. Two consignments of *Cryptolaemus montrouzieri*, Muls., were imported from South Africa and bred readily upon local species of *Pseudococcus*. Several hundred adults and larvae of this Coccinellid were released, but the prospects of the control of *P. brevipes*, Ckll., on pineapple [**28** 145] by it are not considered to be good, since biological control measures have not so far proved successful in Hawaii [*cf.* **24** 176].

Parasites that are to be introduced against *Diatraea venosata*, Wlk., on sugar-cane include an Ichneumonid of the genus *Xanthopimpla*, which parasitises the pupae of a species of *Chilo* on maize in Ceylon, and, in co-operation with Malaya, *Metagonistylum minense*, Tns., and *Lixophaga diatraeae*, Tns., which parasitise the moth-borer [*D. saccharalis*, F.] in the West Indies. A list is given of other parasites and predators of various pests that might be introduced.

FRAPPA (C.). **La menace acridienne et l'organisation de la lutte contre les sauterelles à Madagascar.**—10 pp. Tananarive, Lab. Ent. agric. Inst. Pasteur, 1940.

Much of the contents of this paper has already been noticed [*R.A.E.*, A **22** 8; **24** 236]. The two injurious species of locusts in Madagascar are *Nomadacris septemfasciata*, Serv., and *Locusta migratoria capito*, Sauss.; an outbreak of the latter began in 1939, when swarming was observed in October to the north-west of Betroka on the semi-desert Horombe plateau, in southern Madagascar. The permanent locust control organisation, which was established in 1928, is concerned with periodical surveys of the outbreak centres in the southern and south-western parts of the island, investigations of the effects of climatic factors on the development of outbreaks [**26** 416; **27** 14] and the destruction of locusts. The usual mechanical and chemical control measures are employed and are briefly described.

FRAPPA (C.). **Contribution à l'étude des Oryctes de Madagascar.**—*Bull. écon. Madagascar* (N. S.) no. 12 pp. 344–378, 63 refs. Tananarive, 1937. [Recd. 1939.]

In view of the severe damage caused to coconut palms in Madagascar by Dynastids of the genus *Oryctes*, accounts are given of the appearance of the adults, larvae and pupae of members of the genus, and of the world distribution of the various species. These are divided into five groups, comprising, respectively, those that occur in Europe, Asia, Australia, Africa and Madagascar. The latter group consists of 16 species and varieties, which are dealt with individually, notes being given on their systematic status, the morphology of the adults and their geographical distribution. A key to the adults and a table showing the actual and potential distribution of most of the species in Madagascar and the Comoro and Mascarene Islands and on the east coast of Africa are included. The bionomics of species of *Oryctes* in general, the damage caused by them to coconuts and their control are discussed in detail, largely from the literature. Observations

from 1928 to 1935 showed that a large proportion of the coconut palms in Madagascar were attacked. Since the beetles oviposit in decomposing vegetable matter on the soil or in the stems of decaying palms, clean cultivation of the coconut groves is recommended ; all dead and dying trees should be removed and the débris periodically collected. If it is necessary to keep vegetable matter for compost, it should be piled up in heaps and covered with a layer of sand. Ovipositing females can be attracted to trap mounds of débris or pits filled with leaves, broken palm stems, etc. ; the resulting larvae should be destroyed by hand or by fumigation with carbon bisulphide. Damaged palms should be treated by injecting into the galleries made by the adults a 2–3 per cent. solution of copper sulphate and then filling them in with a clay paste.

In Madagascar, the larvae are parasitised by *Scolia oryctophaga*, Coq., the bionomics of which are described [*cf. R.A.E.*, A **11** 134]. Brief notes are given on a number of other Scoliids found in Madagascar, some of which are probably parasitic on *Oryctes*.

Nyasaland Protectorate. **Annual Report of the Department of Agriculture 1938.**—96 pp. Zomba, 1939.

The Report of the Entomologist (pp. 26–28), by C. Smee, includes a statement that he found evidence of the presence of the eucalyptus snout beetle, *Gonipterus scutellatus*, Gylh., and its Mymarid egg-parasite, *Anaphoidea nitens*, Gir., in Lourenço Marques, Mozambique, in March 1938. Since very few eggs were laid by *Nomadacris septemfasciata*, Serv., in Nyasaland in the breeding season of 1937–38 [*cf. R.A.E.*, A **27** 126], hoppers were scarce in January–March, and adults in March–July. During the last week in July there was renewed activity of swarms, and possibly a re-invasion, as a few flying swarms were observed in most of the districts as far north as Blantyre during August and September, and in all of them in October and November. The swarms of adults did some damage to early maize at higher altitudes towards the end of the year. In December, a few swarms moved further north, and egg-laying was reported early in this month in most of the southern districts containing swarms, and towards the end of the month and in January 1939 in the more northerly districts. The first eggs hatched on 29th December. Infestation did not occur north of latitude 14°S. A list is given of insects identified during the year, showing the parts of Nyasaland in which they had been found. They included the weevils, *Systates hystricodes*, Mshl., and *Blosyrus manicanus*, Mshl., on cotton, the Eumolpids, *Colasposoma instabile*, Har., on nectarines and *Macrocoma apicicornis*, Jac., on coffee, the Cassidid, *Acrocassis soror*, Weise, defoliating *Lagerstroemia*, and *Haplothrips gowdeyi*, Frankl., on oats.

The Report of the Agricultural Officer, Mlanje Experimental Station (pp. 29–37), by A. P. S. Forbes, includes records of pests of tea, together with the results of observations on the bionomics and control of the Limacodid, *Niphadolepis alianta*, Karsch, which have been incorporated in a subsequent paper [see next abstract]. *Paratetranychus* (*Tetranychus*) *bioculatus*, W.-M., was widespread and also caused serious damage to tea. Reinfestation by it was so rapid that sprays were almost ineffective, and infestation was still common a month after the beginning of the rains. In some districts, tea bushes were killed by *Acanthotermes militaris*, Hagen.

In the Report of the Agricultural Officer, Blantyre (pp. 51–62), E. Lawrence states that infestation of cotton by the red bollworm (*Diparopsis castanea*, Hmps.) was severe, but less so than in previous years. Eggs were found from February onwards, and the attack was most noticeable between the end of March and the middle of May. *Dysdercus* spp., particularly *D. intermedius*, Dist., began to appear in May, but were not found in large numbers until the end of July, and then only in certain localities. Many cotton-seed stores, particularly those in which the seed has to remain for some time, were badly infested by *Dysdercus*.

SMEE (C.). **Gelatine Grub on Tea in Nyasaland.**—*E. Afr. agric. J.* **5** no. 2 pp. 134–142, 7 figs. Nairobi, 1939.

Prior to 1938, *Niphadolepis alianta*, Karsch, had occasionally been recorded from tea and coffee in Nyasaland, but had been regarded as unimportant. In 1938 and 1939, however, serious outbreaks of this Limacodid occurred on tea on two estates in the Cholo area, and investigations were carried out on its bionomics and control. It attacks both local (China) and Indian teas growing in all situations. It is considered that it has been increasing over a number of years, its development being facilitated by the vast extension of the food supply and a possible breakdown in natural control. Descriptions are given of the egg, larva and pupa, and of the larval development. The annual cycle of generations has not been ascertained, owing to the variable rate of growth of the larvae and the diapause in the prepupal stage.

The eggs are deposited singly on both surfaces of the leaves. The larvae prefer the hard lower leaves, and make pits on the lower surface without penetrating the upper epidermis. This latter and the edges of the pits rapidly turn brown, which gives to the leaves the appearance of having been attacked by a fungus. Half-grown larvae feed also on the edges of the leaves. As they gradually climb higher up the bushes and attack the younger foliage, the final result is almost complete defoliation. This stage was reached in late May in 1938, and slightly earlier in 1939. Defoliation stimulates a considerable growth of new foliage from buds at the summit of the bushes before pruning can be carried out ; such bushes do not produce a really full cover of foliage in the following year, and a considerable loss of flush may result. The larvae have been found on a number of other plants in Nyasaland ; those that are definitely suitable for their development include castor [*Ricinus communis*], various fruit-trees (particularly apples and plums) and *Aleurites montana*. The duration of the larval stage is very variable ; in the laboratory it lasted 60 days and over for the slower-developing individuals. Pupation usually occurs in a cocoon spun between two leaves or attached to a single leaf by a web of white silk. In May 1938 and in 1939, however, pupation took place largely on the ground at the base of the bushes. The duration of the cocoon stage is also very variable and is complicated by a prepupal diapause that is apparently connected with seasonal conditions. In the laboratory, it lasted from 19 to 191 days.

A Chalcid and a Braconid, possibly a species of *Rhogas*, were reared from the larvae, and a fully developed Tachinid was found in an open puparium inside the cocoon. A Chrysidid wasp was fairly numerous in cocoons in March–April 1939. The Pentatomid, *Macrorhaphis acuta*, Dallas (*spurcata*, Wlk.), has been observed several times feeding on

half-grown larvae, and both the larvae and cocoons were readily destroyed by crows. Only very few diseased larvae and cocoons were found.

Experiments on pruning as a means of control showed that some of the larvae continued to feed on withering prunings lying on the ground for as long as 26 days and formed cocoons, while others migrated to unpruned areas. It is essential, therefore, that the prunings should be burnt as soon as possible, or buried in small quantities under a reasonable covering of soil ; it was proved experimentally that this ensured an almost complete mortality of the larvae in about 14 days, and any moths that emerged were unable to make their way through the soil. These measures would necessitate a large amount of labour and could only be applicable to small areas. It appears, therefore, that regular hand-collection would be the most effective and cheapest method of control, and the employment of permanent collecting gangs is recommended.

HARGREAVES (H.). **Notes on some Pests of Maize and Millets in Uganda.** —*E. Afr. agric. J.* **5** no. 2 pp. 104–109. Nairobi, 1939.

Brief notes are given on the economic importance, and in some cases the bionomics and the appearance of various stages, of some 30 species of insects that attack maize and millets (*Sorghum* and *Eleusine*) in Uganda. Of these, the stalk-borer, *Busseola fusca*, Fuller, is the most important and is discussed at some length. Its biology in Uganda is similar to that observed in the Belgian Congo [*R.A.E.*, A **24** 284]. In addition to maize, it also infests sugar-cane, *Sorghum* and *Pennisetum purpureum*. In captivity, a fertilised female laid 249 eggs in two days. The eggs are attached to the plant or laid in loose clusters of 8–140 under the sheathing base of the leaf ; in December they hatched in ten days. The young larvae first nibble the surface tissues of young leaves at the top of the plant and subsequently bore through the curled leaves. They are parasitised by the Braconid, *Apanteles sesamiae*, Cam. In captivity, the larval stage lasted 7–8 weeks. The recommended control measures include cutting off and destroying the tops of young maize soon after attack, crushing the larvae before they enter the cobs or stems, burning old withered plants, especially if a second crop is to follow on the same land immediately after harvest, and sowing trap plots a few weeks in advance of the main crop to attract concentrated oviposition.

Various caterpillars feed on the leaves of maize, but none of them causes serious injury. They include *Parnara gemella*, Mab., which also attacks sugar-cane ; the egg, larval and pupal stages last about 7, 30–33 and 8–11 days, respectively, and the eggs are parasitised by the Eulophids, *Pleurotropis telenomi*, Crwf., and *P. violacea*, Wtstn. The young seeds are damaged by the larvae of *Argyroploce leucotreta*, Meyr., which chiefly attacks cotton in Uganda and only occasionally becomes a major pest of maize. Evidence was obtained in 1930 that maize sown in the earlier rains may suffer considerable damage, whereas the second crop, grown at a time when cotton is bolling, may be practically uninfested. Other food-plants of this Tortricid in Uganda are orange, castor [*Ricinus communis*], *Sorghum*, *Zizyphus* sp., and many species of *Hibiscus*. The egg, larval and pupal stages last 5, 18 and 12 days, respectively. Pupation occurs in cocoons made of débris and silk under the spathe leaves of the cob, or on the

surface of the soil. The cutworm, *Euxoa longidentifera*, Hmps., attacks maize and many other crops, but normally feeds on weeds. If land is opened up for sowing or planting during dry weather, any cutworms present will die of desiccation or starvation, but if the weather is rainy, sowing should be delayed for two weeks after complete weeding. *Cicadulina mbila*, Naudé, is rarely abundant on maize in Uganda, but is important as a vector of streak disease. The adults of a species of *Megalognatha*, which usually appear in large numbers in April and May, cause local damage to the flowers and young leaves of many plants ; on maize they feed on the tassels and seed embryos.

Pests of *Sorghum* include several that infest the seed heads, and of these *Sitotroga cerealella*, Ol., and *Calandra oryzae*, L., cause severe damage to the stored seed. Such damage is largely prevented if the moisture content of the stored seed is less than 15 per cent. and the store is cool. *Sorghum* seeds that contained 15·7 per cent. moisture and were kept for 9 months in sealed jars were only moderately damaged by *Sitotroga*, whereas seeds with a moisture content of 17·7 per cent. became unfit for human consumption within 3 months.

Grasshoppers are the chief pests of *Eleusine*, one that is particularly injurious in drier areas being a species of *Chrotogonus*. Severe damage by it results when the millet is sown before the rains, as it destroys the young plants when they appear after the first shower and no other food is available. The Coccinellid, *Epilachna similis*, Thnb., which is distributed through Uganda, has caused serious injury in two areas by defoliating *Eleusine* and rice, and to a less extent maize. The armyworms, *Laphygma exempta*, Wlk., and *L. frugiperda*, S. & A., periodically appear in enormous numbers and cause much damage to millet and grazing lands.

Jervis (T. S.). **The Control of the Coffee Berry Borer in Bukoba.**— *E. Afr. agric. J.* **5** no. 2 pp. 121–124, 2 refs. Nairobi, 1939.

In Bukoba (north-western Tanganyika), robusta coffee, which is chiefly cultivated in the humid northern area, yields two-thirds of the total coffee production of the Province. The trees grow to a height of 15 ft. and are allowed to form a dense canopy ; very favourable conditions are thus produced for the berry borer, *Stephanoderes hampei*, Ferr., and infestation by it has been severe. Arabica coffee, which predominates in the drier southern and western parts of Bukoba, is seldom infested, and though the borer becomes more abundant along the shore of Lake Victoria and in sheltered parts of the valley, it appears to be controlled by indigenous parasites. With the increase in the cultivation of robusta coffee in the north, which occurred between 1906 and 1928, the beetle multiplied rapidly and outstripped natural biological control, the infestation being heaviest under conditions of extreme humidity [*cf. R.A.E.*, A **28** 61]. By 1931, the quality of the coffee had markedly deteriorated through borer damage followed by fungous attack, and an effort was made to bring the Scolytid under control. For this purpose, cutting back the low-lying branches was undertaken in 1933, combined with the thinning of some of the heavy vegetative growth, which permitted the air to circulate freely within the trees and so interfered with the activity of the beetle. In addition, the fallen berries were collected and burnt. These measures are now carried out annually in September, when the main crop is already gathered and the secondary crop is insufficiently

advanced to accommodate the egg-clusters of the beetle. As a result, the yield of robusta coffee has increased and its quality has improved.

It is emphasised, however, that the fallen berries must not be destroyed by sweeping aside and burning the surface mulch so that the soil is left exposed. The berries should be sifted out and the mulch replaced, as this will maintain a uniform degree of moisture and temperature over a long period and at the same time prevent surface wash by rain in the wet months.

Le Pelley (R. H.) & Melville (A. R.). **Entomological Work on Coffee.**—*Rep. Dep. Agric. Kenya 1938* **2** pp. 34–41. Nairobi, 1939.

Experiments continued in Kenya in 1938 on the control of *Antestia* [*cf. R.A.E.*, A **25** 219; **27** 667] and reported by Le Pelley showed that the toxicity of mixtures of pyrethrum powder with various substances, including wood ash and tobacco powder, was less than that of pure pyrethrum powder and indicated that apparent saving through the use of a diluent cheaper than pyrethrum would be more than offset by a decrease in the effectiveness of the dust. Further experiments are, however, desirable.

Between May and November, 28 shipments comprising 58 tins of parasites and predators of the coffee mealybug, *Pseudococcus kenyae*, Le Pelley [*cf.* **27** 665] were received from A. R. Melville in Uganda. From these, nine species of primary parasites were reared in Nairobi, of which four Encyrtids, *Anagyrus kivuensis*, Comp., *Anagyrus* sp., *Leptomastix bifasciatus*, Comp., and *Pauridia peregrina*, Timb., were of particular importance; by the end of the year these had been produced in numbers sufficient for liberation, and work was continuing with three others. The weekly production of the four species from September onwards and the liberations made in 1938, which totalled 17,197 parasites, are shown in tables. By 12th March 1939, more than 65,000 parasites had been liberated. A. R. Melville gives an account of his investigations. *P. kenyae* was not found in Nyanza Province, Kenya, but was found on coffee, *Gliricidia maculata* and several other plants at Kampala, Uganda. About 60 per cent. were parasitised. The parasite complex of Kampala and Entebbe was extremely difficult to work out, at least twenty species of primary and secondary parasites being involved. In the Bukalasa area to the north and the Toro district near Fort Portal, it was much simpler. Thirty consignments of parasites were sent from Kampala and 28 from Fort Portal. Predators were scarce, apparently because parasites kept the population of the mealybug so low that numbers sufficiently large to attract predators were rare. The parasites sent were *Leptomastix bifasciatus*, *Anagyrus kivuensis* and *Coccophagus* sp. from Kampala, *Pauridia peregrina* and *Tetracnemus* sp. from Bukalasa and *L. bifasciatus*, *Anagyrus* sp., *Tetracnemus* sp. and *Pseudaphycus* sp. from Fort Portal, and predators were included in each case. *Pseudococcus kenyae* was found to be indigenous in a small area partly in Uganda and partly in Tanganyika, forming an ecological island bounded by distinct natural barriers. Individual parasites varied considerably in importance in different localities. *Pheidole punctulata*, Mayr, was found at many points and the mealybug was vigorously attended, but it was never more than a minor pest. The largest infestations were always found on robusta coffee.

WILKINSON (H.). **Entomological Section. Annual Report of the Entomologist in Charge.**—*Rep. Dep. Agric. Kenya 1938* **2** pp. 71–81. Nairobi, 1939.

A list is given of pests intercepted in plant imports in Kenya during 1938. An unusual interception was that of *Xyleborus coffeae*, Wurth, boring in orchids from Queensland. *Thrips tabaci*, Lind., is present on pyrethrum plants (*Chrysanthemum cinerariaefolium*) on all estates so far examined on which the plant is grown [*cf. R.A.E.*, A **27** 666]. The areas from which the highest yields are obtained (above 7,500 ft.) are also those in which the thrips has not appeared in great numbers. The cooler the situation of a plantation, the less liable is it to severe infestation. It appears that the life-cycle occupies only about 3 weeks in the warmer months (September–February), and the thrips is little in evidence at other times. The adults are usually found in the flower, and infest the leaves only when abundant ; the immature stages are found on the lower surfaces of the leaves and in the flowers, and occur on the stem in cases of severe infestation. When a plant is badly attacked, silvering of the leaves and stem takes place, and these later turn brown and appear dry. The ray florets of the flowers become brown and their grade has to be lowered. Browning and spotting of the flowers after attack by the thrips is due to the fungus, *Alternaria gossypina*, which spreads rapidly when humidity and temperature are high. On light, volcanic soils that dry out rapidly, the effect of infestation by the thrips is aggravated, and plants appear wilted and may produce only few and small flowers. When an outbreak is discovered, the plants should be sprayed with nicotine sulphate (1 : 500) or with proprietary lime-sulphur (1 : 80). In severe infestations, spraying is uneconomic, as it would have to be repeated at fortnightly intervals. In such cases, the plants should be cut back before treatment.

Two medium-sized swarms of *Nomadacris septemfasciata*, Serv., entered North Kavirondo from Uganda on 15th and 19th May, respectively. They caused only very slight damage to crops and did not oviposit. By the first week in July, the small swarms into which they had broken up had either returned to Uganda or had been destroyed by natural enemies and diseases, and Kenya became for a time entirely free from locusts. Between 27th July and 23rd August, several large swarms of *Locusta migratoria migratorioides*, R. & F., entered the north-west of the Colony from the Sudan and flew in a south-easterly or southerly direction. Only one swarm is known to have entered through Uganda. Oviposition took place over wide areas, and hopper infestation was severe in certain districts. In Nyanza and Nzoia Provinces, oviposition commenced at the beginning of October, but in Nakuru Province, it did not occur until the first week in November. There were clear indications that the various swarms oviposited at least 4 and probably 5 or 6 times at intervals of 8–12 days. The Government was advised to begin preparations for the destruction of the hoppers on 6th September, and the first hatching took place on 22nd October. The period available for preparation and the efficient organisation resulted in a completely successful campaign, and over 99 per cent. of the eggs and hoppers were destroyed. Baits are by far the most efficient and economic method of destroying hoppers in Kenya. During the campaign, over 4½ million lb. of bait was issued.

The Cerambycid, *Oemida gahani*, Dist., which infests the timber of *Podocarpus gracilior*, is becoming a serious menace to the structure of many of the earlier buildings in Nairobi; in one hotel, its work has rendered necessary structural alterations costing several thousand pounds. The exit holes made by the adult are small, varying from 2×1 to 5×3 mm. Injection of small amounts of a solution of para-dichlorobenzene followed by the plugging of the holes with putty was relatively successful.

MEGAW (W. J.). **Report on the Flax Industry in Kenya.**—18 pp. Nairobi [Kenya Dep. Agric.], 1939.

This report on the cultivation of flax in Kenya contains notes by T. A. Wilkinson (pp. 17–18) on factors influencing infestation by *Plusia* (*Phytometra*) *orichalcea*, F., which is the only important insect pest of this crop in the Colony. In past years, flax has been grown on a large scale and, as a result of this extensive cultivation, especially in areas not suited to the production of high-grade fibre, outbreaks of this Noctuid have occurred and severe losses have been sustained. Experience has shown that flax grown in small acreages is less liable to attack, and that infestation is more severe in areas subject to periods of little rainfall during the growth of the crop. It is suggested that large acreages on the same farm and areas of relatively low average rainfall, unevenly distributed, should be avoided; areas between 6,000 and 7,000 ft. that may be considered reasonably safe from attack and those in which the risk is too great are enumerated.

FOSCOLO (E.) & LEFÈVRE (P. C.). **Culture et parasites de la patate douce dans l'Ituri.**—*Bull. agric. Congo belge* **30** no. 3 pp. 404–420, 3 figs., 12 refs. Brussels, 1939. (With a Summary in Flemish.)

The more important pests of sweet potato (*Ipomoea batatas*) in the Province of Ituri, Belgian Congo, are *Acraea acerata*, Hew., *Herse convolvuli*, L., *Hippotion celerio*, L., *Diacrisia investigatorum*, Karsch, and *Phaedonia aerata*, F., all of which attack the leaves, *Tipulamima pyrostoma*, Meyr., which infests the stems and root-collar, a species of *Pseudococcus* that is commonly found in the galleries made in the root-collar by this Aegeriid, *Cylas formicarius*, F., and *C. puncticollis*, Boh., which attack the leaves, stems and tubers, and the cutworms, *Agrotis* (*Euxoa*) *segetum*, Schiff., and *A. ypsilon*, Hfn. Only brief notes are given on the pests other than *T. pyrostoma*, which is very common in Ituri and of which all stages are briefly described. This moth has two generations annually, oviposition occurring at the beginning and about the middle of the year. Observations showed that insufficient rainfall in January–February or June–July results in outbreaks and a poor crop. The eggs are laid singly, chiefly in natural cavities on the root-collar, and hatch in about 10 days. The larvae tunnel in the root-collar, 2 or 3 being commonly found in one plant, but pupate in the stems; the pupal stage lasts about 30 days. The adults are active at dusk and during the night. A species of *Solanum* that is common in abandoned native villages is an alternative food-plant. The percentage infestation of sweet potato showed considerable local variation, but was higher at the edges of fields in the vicinity of the bush than in the centre, probably owing partly to the higher humidity of the soil there. Some varietal resistance to infestation was observed.

T. pyrostoma is parasitised to a negligible extent by an undetermined Ichneumonid. Cultural methods are recommended for control and include crop rotation, earthing up the plants to protect the root-collar from ovipositing females, burning tops and débris after the harvest, planting three-months-old slips at such dates that the plants are at least six months old at the beginning of the dry season and are thus able to resist attack, destroying alternative food-plants and planting new fields at a distance from infested ones.

CHAMBERLAIN (E. E.). **Cucumber-mosaic** (*Cucumis Virus* **1 of Smith, 1937**).—*N.Z. J. Sci. Tech.* (A) **21** no. 2 pp. 73a–90a, 7 figs., 39 refs. Wellington, N.Z., 1939.

An account, taken partly from the literature, is given of the distribution and economic importance of cucumber mosaic, caused by *Cucumis* virus 1, the physical properties of the virus, the symptoms of the disease in different plants, and the ways in which it is transmitted. In New Zealand, the disease is of local economic importance in out-door cucumbers, tomato, vegetable marrow and melon; polyanthus (*Primula polyantha*) was also found naturally infected. The yield from tomatos experimentally inoculated with the virus was 79 per cent. less than that from healthy plants. The virus can readily be transmitted mechanically from diseased to healthy plants [*R.A.E.*, A **13** 274], and may be spread in this way in New Zealand during cultural operations. The results of experiments on its transmission by Aphids are shown in a table. In these tests, *Myzus persicae*, Sulz., *Aphis gossypii*, Glov., and *Macrosiphum solani*, Kalt., transmitted the virus and *M. solanifolii*, Ashm., did not [but *cf.* **17** 219; **18** 417]. *Myzus persicae* infected tobacco and lupin in addition to cucumber and tomato. In preliminary investigations, the virus was transmitted through the seed of marrow, but not through that of tomato or cucumber. A list is given of the plants experimentally infected by mechanical methods. The control measures recommended comprise using seed from healthy plants; growing crops as far as possible from flower gardens and other susceptible crops; eradicating susceptible weeds; and inspecting the crops and removing infected plants. Healthy plants should not be touched after diseased ones have been handled.

JEFFREYS (F. J.). **A new Pest of Raspberry in New Zealand** (*Priophorus tener* **Zaddach**).—*N.Z. J. Sci. Tech.* (A) **21** no. 2 pp. 107a–113a, 8 figs., 6 refs. Wellington, N.Z., 1939.

Descriptions are given of the egg, larva, prepupa and adult of *Priophorus tener*, Zaddach, larvae of which were observed feeding in the foliage of raspberry in 1936 and 1937 and of blackberry in 1938 in South Canterbury [*cf. R.A.E.*, A **28** 99]. This is the first record from New Zealand of this European sawfly; its distribution and synonymy are summarised from the literature. Larvae were collected in the field in March in all three years; the majority overwintered as prepupae, but from one cocoon that was formed about 5th March 1937, a female emerged on 11th April, and oviposited on raspberry. The resulting larvae spun cocoons between 26th May and 29th June and overwintered as prepupae. Pupation of the overwintered generation occurred in August and the adults emerged in September. Adults

of the generation that produced the full-fed larvae found in March were taken in the field in December 1936. It thus appears that there are normally two generations a year. All the adults observed were females. A key is given to the females of *P. tener* and of *Caliroa* (*Eriocampoides*) *limacina*, Retz. (pear slug) and *Nematus* (*Pontania*) *proximus*, Lep. (willow sawfly), two other exotic sawflies that occur in New Zealand.

JEFFREYS (F. J.). **The Raspberry-bud Moth** (*Carposina adreptella* **Walk.**).—*N.Z. J. Sci. Tech.* (A) **21** no. 2 pp. 114a–125a, 11 figs., 4 refs. Wellington, N.Z., 1939.

An account is given of investigations on the life-history of *Carposina adreptella*, Wlk. [*cf. R.A.E.*, A **28** 99], which is widely distributed in both the North and South Islands of New Zealand and caused considerable damage to raspberry in the Nelson district in 1936–37. All stages of this Tineid are described. The eggs are laid singly or in clusters between the leaves in the buds of raspberry, on the lower surface of the leaves or, occasionally, on their upper surface. The egg stage lasted 5½ days or less at the beginning of April, 13–19 days at the end of April and beginning of May, and 21 days in July. The newly hatched larva bores into the bud on which the egg was laid, or wanders until it finds a bud, leaf or fruit on which to feed. If the terminal bud is attacked, the larva may tunnel for 3–4 ins. down the succulent shoot, probably remaining there until mature. In other cases, it migrates from bud to bud to obtain sufficient food. In late autumn, the larvae sometimes shelter under a web covered with frass, and feed on the lower surface of the leaves, leaving the upper epidermis intact. Larvae in all instars were observed on the leaves of blackberry during the winter, and the characteristic damage to the leaves was also seen on lawyer (*Rubus australis*), though no larvae were found. In the spring and summer they attack the flower buds and fruit of blackberry, but the destruction of the lateral buds was less noticeable than in raspberry.

The larvae were unable to spin cocoons over dry sand, but did so soon after it was moistened. Larvae that were kept in water or in very moist conditions for two or three days were able to spin their cocoons afterwards. Comparison of the intensity of infestation during periods of different rainfall indicated that its increase is probably favoured by high humidity and checked by low humidity, though in the laboratory a fungus caused heavy mortality of larvae under moist conditions. In cages, the cocoons were formed in the sand at the bottom and on the leaves, covered with grains of sand or larval frass. No pupae were found on canes in the field, and in nature the pupal stage is probably passed in the soil. The larvae usually pupated 4–5 days after completing their cocoons, and the pupal stage lasted 2–6 weeks, being longest in the winter. The adults were most active at dusk and in the early evening, but sometimes flew throughout the night. Males usually survived for shorter periods than females. Two pairs lived for three weeks under laboratory conditions, but others died within a few days of emergence. Eggs were rarely laid in the first week after emergence; one newly emerged female was found to contain about 200. Ovipositing females reared from larvae on blackberry preferred blackberry and *R. australis* to raspberry.

The life-cycle lasted about 2½ months in the laboratory in February–April. There is probably no definite hibernation, but merely slower development in winter, since eggs hatched in 3 weeks in July, larvae in all instars were found on blackberry leaves in June and in the dormant buds of raspberry in August and September, and adults emerged throughout the winter from material collected in autumn and stored in an outdoor insectary, though none was found in the field. If food was available, larvae predominated during winter. There are probably 4 generations a year.

The larvae are parasitised by *Apanteles carposinae*, Wlkn. [*cf.* **27** 37] and, in smaller numbers, by an unidentified Ichneumonid. *A. carposinae* is a solitary parasite and leaves its host when the latter is in the last instar, usually after it has spun its cocoon. In this case, it pupates in the cocoon of the host. Blackberry infested by *C. adreptella* was collected in two districts in March and April 1937 and caged, and the moths and adults of *Apanteles* emerging were counted. In one district 36 per cent., and in the other 27 per cent. of the total were *Apanteles*. The parasites emerged 1–2 weeks before the moths, and emergence occurred throughout the winter from material collected in autumn.

The author considers that severe infestations of *Carposina* are built up in an individual garden over a period of years and are not due to large-scale migrations from an outside source. He therefore recommends that the bushes be pruned as early in the autumn as possible, to destroy larvae and remove succulent growth. Applications of insecticides would have to be made at frequent intervals to protect the young growth in spring, and chemical control would therefore probably prove too expensive.

Smith (J. H.). **Insects and their Influence on Agricultural Development.**—*J. Aust. Inst. agric. Sci.* **5** no. 3 pp. 148–153. Sydney, 1939.

This paper on insects as a limiting factor in rural development deals in particular with crop pests in Queensland. Two instances are given of indigenous species becoming serious pests through ecological changes brought about by development : clearing provided additional treeless areas suitable for oviposition by *Chortoicetes terminifera*, Wlk., and increased the available food-supplies for white grubs (*Lepidiota caudata*, Blkb.), which later curtailed the yield of pasture. It is pointed out that the choice of areas for the growing of certain crops may have to be determined in part by entomological considerations. For example, northern Queensland would probably be climatically more suitable for banana growing than the south, but the presence in the north of *Dacus* (*Chaetodacus*) *musae*, Tryon, and of *Scirtothrips signipennis*, Bagn., in destructive numbers would prevent the success of large-scale cultivation unless adequate control measures could be practised. From the point of view of soil and climate, some parts of the Darling Downs should be equal to the Stanthorpe district for the production of stone fruit, but the annual losses due to *Dacus* (*C.*) *ferrugineus tryoni*, Frogg., make major development almost impossible. Existing entomological knowledge is frequently insufficient to enable a forecast to be made of the pest trends in any developmental project. Exotic pests may be excluded, but many indigenous species readily adapt themselves to introduced crops, as *D. f. tryoni* has done.

On the other hand, *Ceratitis capitata*, Wied., a widely distributed and important pest, which became established in Western Australia and New South Wales and has steadily increased in importance in the former and attacked fruits previously thought to be immune, has lost ground in New South Wales and has never been bred in Queensland from locally grown fruit. Some insects attack plants irrespective of their vigour, but others only seriously injure weak plants. *Cosmopolites sordidus*, Germ., has long been regarded as a major pest of bananas, but it has now been established that the susceptibility of a plant to attack by this weevil is largely determined by its vigour. It is concluded from this that it is unwise to assume that a pest is the first cause of the failure of a crop unless cultural conditions are ideal, which is seldom the case when land is first settled.

Codling Moth and Black Spot. Third Annual Report of the Apple and Pear Demonstration Plots.—*J. Dep. Agric. Vict.* **37** pt. 9 pp. 423–426, 443–452, 4 figs. Melbourne, 1939.

In this paper, work on the control of *Cydia pomonella*, L., on apple and pear in Victoria in 1936–39 is summarised and recommendations based on it are made; the results of investigations during the first two seasons have already been noticed [*R.A.E.*, A **26** 168; **27** 20]. During 1938–39, there were again two broods of *C. pomonella* in most districts, and conditions were particularly favourable for the spring brood. Despite considerable local variations in activity, observations indicate the existence of four classes of districts, for which distinct recommendations are made. Of baits used for timing the sprays, one containing sweet red wine (10 per cent.) was again the most effective [*cf.* **27** 20], but apple juice and cider are also satisfactory. Golden syrup and molasses are less reliable and less convenient to use, and large numbers of insects other than *C. pomonella* are attracted by them.

In inland districts, where lead-arsenate sprays have not proved highly effective, summer white oil [**27** 20] was widely used on apple with satisfactory results, its success being made possible by the careful timing of the applications. The efficiency of the schedule was increased by using lead arsenate and oil together in the first two cover sprays; the danger of excessive arsenical residue was avoided by the use of only a small amount of casein (instead of calcium caseinate) as a spreader, and in one district the residue was within the legal tolerance. In most of the southern districts, adequate control was given by lead arsenate, and the use of white oil was generally restricted to the last 3 or 4 sprays, partly because under certain conditions such as shortage of water, the variety most extensively grown in this area is susceptible to the type of oil injury known as lenticel blotch. Increased control was given by the use of both insecticides in the early cover sprays on two plots on which lead arsenate alone was previously unsatisfactory [**27** 20].

Experiments indicate that white oil is effective at a concentration of 1 : 80 when used alone, and 1 : 100 in combination with lead arsenate. Furthermore, it is of value against San José scale [*Aspidiotus perniciosus*, Comst.].

On pears, a schedule of lead-arsenate sprays alone is satisfactory if the calyx spray is sufficiently heavy to saturate all the calyces, and if hessian bands, which are superior to chemically treated bands on pear,

are used as a supplementary measure. A combined spray of lead arsenate and white oil (1 : 80) applied throughout the season afforded slightly better control on canning pears than lead arsenate alone, but owing to the low initial population of *C. pomonella*, the results are regarded as inconclusive.

The use on experimental plots of corrugated cardboard bands impregnated with beta-naphthol in oil continued to give satisfactory results as a supplementary measure on apple [**26** 168]; the number of moths emerging from the bands averaged less than 2 per cent. of the number of larvae in them. It is essential, however, for the bands to fit snugly, as otherwise many larvae pupate on the bark under them. Treated bands should be applied in mid-November in the Goulburn Valley and a fortnight later elsewhere, and should be removed and destroyed in June or July of the following year.

Mungomery (R. W.). **A Mound-building Ant affecting Sugar-cane.**—*Qd agric. J.* **52** pt. 3 pp. 314–315. Brisbane, 1939.

Mound-building ants have recently become of importance as pests of sugar-cane in several districts of Queensland. It is thought that at least two similar species are concerned, but in this paper they are not named [*cf. R.A.E.*, A **16** 98]. The ants are active by night and construct small mounds round the bases of cane stools under which their nests are excavated; as a result of the extensive tunnelling, the soil dries out, causing the canes to become severely stunted, and the root hairs are damaged, although the ants probably do not feed on them. They tend colonies of Aphids on the roots of sugar-cane, and on those of blady grass [*Imperata arundinacea*] in uncultivated land. Nests in waste land serve as a source of infestation for neighbouring cane-fields, and where their eradication is impracticable, all self-sown canes and grasses in the cane-fields should be removed when the ratoons are ploughed out, and the fields either left bare or thickly sown with a quick-growing leguminous crop. When this is ploughed under, any nests that remain should be destroyed by further ploughing or by fumigation with carbon bisulphide or a mixture of carbon bisulphide and paradichlorobenzene. Soil fumigation is also effective when the ants begin to invade young plant cane or ratoons.

Annual Report of the Sub-department of the Prickly-pear Land Commission for the Year 1938–39.—*Rep. Land Adm. Bd Qd 1938–39*, repr. 8 pp., 1 pl. Brisbane, 1939.

A brief section of this report deals with the biological control of prickly-pear [*Opuntia* spp.] in Queensland in 1938–39 [*cf. R.A.E.*, A **27** 344]. Heavy rains in early and late summer favoured prickly-pear and much new growth and many seedlings developed in several districts. December and January were dry and very hot, with intense heat waves in certain districts, but this did not affect the population of *Cactoblastis* [*cactorum*, Berg] so much as might have been expected, though the increase of this Pyralid was reduced in those sections in which conditions were most severe. On the whole, the population was more than maintained, and excellent control is being exercised in most areas. The cochineal insect [*Dactylopius opuntiae*, Ckll.] was not so active as in 1937–38. During the year, 13,200 adults of the

Lamiid, *Lagochirus funestus*, Thoms., were distributed in areas in central Queensland in which tree-pears (*O. tomentosa* and *O. streptacantha*) occur, and earlier liberations made a good recovery from the setback caused by the hot, dry midsummer of 1937–38. Seedlings of *O. tomentosa*, of which there were unusually large numbers, were controlled by *D. opuntiae*. The Argentine strain of *D. confusus*, Ckll., gave satisfactory control of tiger-pear (*Opuntia aurantiaca*).

Currie (G. A.) & Fyfe (R. V.). **The Lantana Bug in Australia. Progress Report.**—*J. Coun. sci. industr. Res. Aust.* **12** no. 3 pp. 259–263, 1 ref. Melbourne, 1939.

The Tingid, *Teleonemia lantanae*, Dist., which the authors consider a synonym of *T. scrupulosa*, Stål, was introduced into Australia from Fiji against the noxious weed, *Lantana camara*, in 1936 [*cf. R.A.E.*, A **26** 86]. In insectaries at Canberra, the bugs readily established themselves on potted *Lantana* plants in the summer and early autumn of that year, but they ceased to breed and their numbers dwindled rapidly with the onset of colder weather in late autumn and winter. When the survivors were transferred to a heated insectary, they regained activity and began to breed again. Observations showed that the bugs defoliated their food-plants very rapidly and that the females oviposited freely only when flowers were available for feeding; the eggs were laid on young leaves, and the nymphs fed on leaves and growing tips. The following technique was, therefore, adopted: a suitable temperature was maintained in the insectary, the adults were placed in a compartment containing fresh *Lantana* plants in bloom mixed with fresh young growth, and when enough eggs had been deposited on a plant, it was placed in the main part in the insectary, where the eggs hatched and the nymphs were allowed to develop to the adult stage. The plants that had been used for rearing were then cleared of the bugs and of all their remaining leaves and were allowed to recover in a glasshouse before being used again. By this system, bugs could be produced in numbers at any time.

The first liberation was made in October 1936, and by April 1939 colonies had been released in three districts in New South Wales and in two in Queensland [*cf.* **27** 546]; the date and place of the liberations, as well as the stage and number of the bugs, are shown in a table, and notes are given on the success or failure of the attempts. In Queensland, the bugs have become very abundant and have greatly reduced *Lantana* in one area in the tropical north following a single liberation, but have little more than held their own in a district on the Tropic of Capricorn. They have not yet become firmly established in north-eastern New South Wales, about latitude 29°S., although several colonies were liberated there in three different localities. This difference in results is probably due to climate, but there are also indications that predators attack the bugs more severely in the southern areas.

It is pointed out that *Teleonemia* is unlikely to control *Lantana* directly, as it cannot maintain a high level of population over a period sufficient to destroy young shoots as they appear unless flowers and young shoots are available continuously for breeding, and this does not appear possible in the field owing to the speed with which the flowers are destroyed when the adults are numerous. Periods of great

damage to *Lantana* will therefore alternate with periods of regrowth. However, any periodic extensive damage will give other vegetation an advantage, which may enable it to displace *Lantana*.

Bondar (G.). **O coqueiro** (*Cocos nucifera* **L.**) **no Brasil.** [The Coconut in Brazil.]—*Bol. Inst. cent. Fom. econ. Bahia* no. 7, 100 pp., 21 pls., 39 refs. Bahia, 1939.

This work deals with the cultivation and products of the coconut palm, *Cocos nucifera*, in Brazil, where it has been cultivated for four centuries, but has been neglected, there being, it is estimated, only 5 million palms instead of a possible 106 million. The few papers published on its insect pests in Brazil are by the present author [*R.A.E.*, A **3** 695; **10** 53, 95; **11** 120; **13** 561]; brief notes on the bionomics and control of some of them are given, but the only additional species recorded is the Dynastid, *Strategus aloeus*, L.

Llanos (V. V.). **El** *Alabama* **en la zona algodonera de Armero.** [*Alabama argillacea* in the Armero Cotton District.]—*Rev. Fac. nac. Agron.* (*Colombia*) **1** no. 2 pp. 149–182, 8 figs., 3 pls., 8 refs. Medellín, 1939.

An account is given of observations on the life-history and control of *Alabama argillacea*, Hb., on cotton in the Armero district of Colombia, and all stages of this Noctuid are described. It has 12 generations a year in Armero, and 6 were observed in the crop season from September 1937 to February 1938. The durations of the egg, larval, prepupal and pupal stages averaged 3, 10, 1½ and 8 days, and females began to oviposit 2 days after emergence. Adult longevity varied from 3 to 12 days.

Some plantations are free from attack, though surrounded by infested fields, and this is believed to be due to natural enemies. Those observed included two species of *Polistes*, three Pentatomids, three Sarcophagids, *Brachymeria comitator*, Wlk., and another Chalcid of the same genus. Of these, *B. comitator*, which parasitises the pupae, was the most important. Its development is completed in 15 days, and as the adult lives for 85 days, it can parasitise three successive generations of *A. argillacea*. The only insecticide used is a dust of undiluted calcium arsenate, and as this is expensive it is suggested that it should be mixed with lime.

Du Bois (J. J.). **Note on Injury to** *Gypsophila paniculata* **by the Jerusalem Cricket,** *Stenopelmatus fuscus* **Hald. (Tettigoniidae-Orthoptera).**—*Bull. Brooklyn ent. Soc.* **34** no. 5 p. 244. Lancaster, Pa, 1939.

A ten-acre plantation of the double-flowered form of *Gypsophila paniculata* at Turlock, California, has been damaged by *Stenopelmatus fuscus*, Hald., which destroyed 10–25 per cent. of the young plants. The infestation was greatest on new land that had been overgrown by weeds. The insects came to the surface at night and early morning and did most damage in early spring, during the period of active growth of the plants.

Ting (P. C.). *Pachybrachys hybridus* **Suffr. as a Pest of Heather (Coleoptera, Chrysomelidae).**—*Pan-Pacif. Ent.* **15** no. 4 p. 182. San Francisco, Calif., 1939.

The Cryptocephalid, *Pachybrachys hybridus*, Suffr., was observed doing serious damage to the growing tips of young heather plants at San Carlos, California, in May 1939. Many of the tender tips had been eaten half way through and had wilted or fallen over.

Fenton (F. A.). **Control of Shade Tree Borers.**—*Circ. Okla. agric. Exp. Sta.* no. 84, 28 pp., 19 figs. Stillwater, Okla., 1939.

This circular deals with the commoner insects that bore in the wood of shade trees in Oklahoma ; they comprise 12 beetles, the Coccid, *Prionoxystus robiniae*, Peck, the Siricid, *Tremex columba*, L., and the ant, *Camponotus herculeanus*, L. Brief notes are given on the bionomics and control of most of them, but the flat-headed apple-tree borer, *Chrysobothris femorata*, Ol., which annually kills thousands of recently transplanted trees and is particularly injurious to American elm [*Ulmus americana*], is discussed in greater detail [*cf. R.A.E.*, A **26** 136]. All stages of this Buprestid are briefly described. The recommended control measures are : wrapping the trees with paper [*cf.* **26** 543 ; **27** 178, 420] ; removing the larvae during the summer by cutting away the entire injured area and treating the exposed cambium with shellac to protect it from fungi ; keeping the trees healthy by improved cultivation ; planting Chinese elm [*U. pumila*], which is relatively resistant ; and burning dead branches and trees, especially those killed by the borer, before spring, to destroy hibernating larvae. Probing the galleries of the larvae with a fine wire is ineffective, as after reaching the heart wood,the tunnels are continued at right angles to the entrance gallery.

An index to the trees is given, showing the pests that attack each.

Schultz (E. F.). **La mariposa de las naranjas** (*Gymnandrosoma* **sp.).** [The Orange Moth.]—*Rev. industr. agríc. Tucumán* **29** no. 4–6 pp. 87–90. Tucumán, 1939.

In 1937, oranges and mandarins in Tucumán, Argentina, were infested by the larvae of a Tortricid of the genus *Gymnandrosoma*, probably *G. aurantianum*, Costa Lima, which caused them to drop. In 1938–39, the attack was more severe in *Citrus* plantations near the mountain slopes, the infestation having probably originated on wild orange trees on the slopes. In 1939, the attack increased in severity and extended to lemons, grapefruit and limes. Until the biology of the moth is known, the only control measure that can be recommended is that all fallen and infested fruit should be collected and buried to a depth of at least 3 feet.

Kreibohm de la Vega (G. A.). **Métodos sencillos para notar la presencia de la oruga de la hoja en un algodonal** (*Alabama argillacea* **Hübn.**). [Simple Methods for determining the Presence of *A. argillacea* in a Cotton Field.]—*Rev. industr. agríc. Tucumán* **29** no. 4–6 pp. 107–114, 7 figs. Tucumán, 1939.

The author gives brief descriptions of the adult, egg and larva of *Alabama argillacea*, Hb., and a detailed account of the type of damage caused by the larvae to the leaves of cotton, in order that cotton

growers in Tucumán, Argentina, may be able to recognise the presence of infestation and decide whether the application of an insecticide is necessary.

PAPERS NOTICED BY TITLE ONLY.

MESNIL (L.). **Essai sur les Tachinaires (Larvaevoridae)** [a classification of the Tachinids into subfamilies, tribes and groups].—*Monogr. Sta. Lab. Rech. agron.* 67 & v pp., 2 pls., 22 refs. Paris, 1939.

MAMET (R.). **Some new Genera and Species of Coccidae (Hemipt. Homopt.) from Mauritius** [including *Aspidiotus subterraneus*, sp. n., on rhizomes of ginger (*Zingiber officinale*)].—*Trans. R. ent. Soc. Lond.* **89** pt. 13 pp. 579–589, 7 figs. London, 1939.

INOUYE (MOTONORI). **On eight Conifer Aphids occurring in Hokkaido** [including new species].—*Insecta Matsum.* **13** no. 4 pp. 132–142, 3 figs. Sapporo, 1939.

SHULL (A. F.). **Distribution of intermediate-winged Aphids in the Family and its Bearing on the Mode of their Production.**—*Amer. Nat.* **73** pp. 256–269, 2 figs., 5 refs. Boston, Mass., 1939.

SAMPSON (W. W.). **California Aphids of the Genus** *Phorodon* [including *P. phloxae*, sp. n., from *Phlox subulata*].—*Pan-Pacif. Ent.* **15** no. 4 pp. 173–175, 1 fig. San Francisco, Calif., 1939.

DREWS (E. A.). **A Contribution to the Knowledge of the Aphididae of Nevada.**—*Pan-Pacif. Ent.* **15** no. 4 pp. 175–178, 7 refs. San Francisco, Calif., 1939.

CUSHMAN (R. A.). **A new** *Angitia* [*platyptiliae*, sp. n.], **parasitic on the Artichoke Plume-moth** [*Platyptilia carduidactyla*, Riley, in California] **(Hymenoptera, Ichneumonidae).**—*Pan-Pacif. Ent.* **15** no. 4 pp. 183–185. San Francisco, Calif., 1939.

YUASA (H.). *Cosmopolites sordidus* **Germ. found in the Bonin and Loochoo Islands.** [*In Japanese.*]—*Ōyō Kontyū* **2** no. 3 pp. 116–118, 2 figs. Tokyo, 1939.

BUTOVITSCH (V.). **Ueber die Oekologie und das forstliche Verhalten von** *Ips typographus* **L.** [On the Ecology and Behaviour in the Forest of *I. typographus* (on spruce in Sweden).]—*Verh. 7. int. Kongr. Ent. Berlin 1938* **3** pp. 1922–1929, 3 figs., 2 pls. Weimar, 1939. [*Cf. R.A.E.*, A **27** 122.]

STAIG (R. A.). **The Fabrician Types of Insects in the Hunterian Collection at Glasgow University. Coleoptera. Part II.**—Demy 8vo, x+164 pp., 31 col. pls. Cambridge Univ. Press, 1940. Price 27*s.* 6*d.* [*Cf. R.A.E.*, A **19** 176.]

MARTORELL (L. F.). **Insects observed in the State of Aragua, Venezuela, South America** [a briefly annotated list].—*J. Agric. Univ. P.R.* **23** no. 4 pp. 177–232. Rio Piedras, P.R., 1939.

MARTORELL (L. F.) & ESCALONA SALAS (A.). **Additional Insect Records from Venezuela.**—*T.c.* pp. 233–264.

KING (K. M.). **Population Studies of Soil Insects** [a general discussion].—*Ecol. Monogr.* **9** no. 3 pp. 270–286, 32 refs. Durham, N.C., 1939.

JONES (H. A.). **Colorimetric Evaluation of Derris and Cubé Roots.**—*Industr. Engng Chem.* (Anal. Edn) **11** pp. 429–431, 26 refs. Easton, Pa., 1939.

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